Current Science

Vol. XXII] JULY 1953 [No. 7

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SOIL HUSBANDRY IN INDIA

SOIL husbandry in its widest sense includes not only measures to combat soil erosion which is assuming serious proportions in our country, but implies also a fundamental study of the various properties of the soil with a view ultimately to maintain its productivity at the highest possible level.

For soil husbandry to come into its own in our country, a two-pronged development would seem to be essential: the first is an assessment of the magnitude of the erosion problem based upon an All-India survey of soil and land utilisation; the second, an intensification of soil studies paying due attention to local conditions and potentialities and also to the urgency of the food situation in the country.

Data on soils and utilisation have been collected in the past by irrigation departments in the various States, by experimental stations in agriculture, by the Universities and other institutions. But such data have been confined to limited areas scattered in different parts of the country, and further, the techniques of classification used by the different agencies vary greatly. The need for an All-India Survey is therefore obvious, and such survey should be carried out by a Central Agency so that there is uniformity in regard to systems of classification, surveying and mapping techniques, and above all, scientific terminology, so that results from the different areas may admit of comparison and co-ordination. Programmes of soil survey and testing of soils, which are at present being carried on by the various agencies, should be co-ordinated with the work of such a survey.

Though adequate basic data are lacking, it is clear that the losses in acreage and production due to soil erosion are considerable. Throughout India, on all sloping grounds not covered by forests or shrubby vegetation, and on agricultural land not properly terraced and embanked, erosion of the soil is always going on. Soil erosion assumes several forms. Sheet erosion, which occurs on flat cultivated lands having no plant cover is responsible for greater loss than all the other forms of erosion put together. It has been calculated that in the black cotton soil of Sholapur, Bombay, 133 tons of soil per acre are lost per annum. The most striking example of soil erosion in India are to be found south of the Jamuna in Budelkhand, in Central India, in Bihar, and in parts of Bombay, Madras and the Punjab. River bank erosion and sand deposition are assuming menacing dimensions in Assam and

West Bengal, where the rainfall is heavy. Wind erosion has also been responsible for the loss of valuable top layers of the soil in many areas. Thus, in the Indus Valley, recent deforestation in the Thal has allowed the wind to blow the soil away.

The causes of erosion are generally destruction of forests, shifting cultivation, deterioration of village pastures, and faulty methods of cultivation. The cure naturally is the restoration of vegetation in such areas to protect the soil from the erosive action of wind and water. This is secured by the afforestation of the upper catchment areas of rivers; proper and sustained management and care of both the village and reserve forests; limitation of flocks and herds to the number which vegetation can support; improved agricultural practices, such as terracing, levelling and contour bunding and proper systems of drainage.

Legislation as provided for in the Five-Year Plan is no doubt necessary and must be given effect to, if the erosion problem is not to become even more serious than at present; but quite as much, if not more, can be achieved by educating the public in regard to the social aspects of soil husbandry. Erosion is after all the result of man's misuse of land. It is his needs of timber and fuel, fodder and food, which have led to the destruction of the soil. Infusing a spirit of enlightened self-interest among the cultivators would, therefore, seem to be an urgent necessity. The cultivator must not only be convinced of the need for dealing with soil erosion; the State must also secure through right propaganda, his willing co-operation in regard to various measures to be adopted for proper husbandry of the soil.

A perusal of the Final Report of the All-India Soil Survey Scheme recently issued indeed convinces that fundamental studies on soils have not been lacking in our country. The major lines along which such studies have proceeded so far are: soil studies in relation to content of plant nutrients, and assessment of soil fertility, improvement of soil fertility and productivity, soil studies in relation to irrigation, and soil classification, soil surveys and soil maps. But the authors of the Report have had to admit that the data so far obtained are rather scanty. Besides, even this very limited volume of work has been carried out mostly (with but a few rare exceptions relating to profile study) using old methods of approach. Most of the analytical data are confined usually to surface soils and in some cases only, to the sub-soils. Further, the sampling and analytical procedures are not always uniform. Excepting a few cases, the number of samples has been found to be too few for advisory work on matters of soil fertility.

The Report also recommends that in soil studies bearing on irrigation, more stress should be given to soil texture and soil profile, drainage, water requirements of crops moisture-holding and moisture-yielding capacity of soils. The information on the effect of micronutrient elements on crop yields and deficiency diseases of plants and animals can hardly be regarded as either adequate or satisfactory. It should form, as in other countries, a major line of investigation, because of the spectacular effect the micronutrients have shown on crop yield and curing of diseases of animals arising out of deficiencies in the fodder and food crops. Soil maps based on insufficient survey do not promise to be very helpful, although some useful attempts have been made in this direction by geologists and soil scientists.

Also, the effect of combination of fertilisers and their interaction requires to be studied more systematically. In view of the importance of the micronutrient elements, their effect should also be included in the manurial trials.

Considering that the basis of our national economy is agriculture, perhaps it is only fair to remark that the status of soil husbandry in our country is not what it should be at the present moment. But, there are indications—the formation of a Soil Conservation Society of India being one,—that a realistic approach is being made both by the scientists and the Government to face the issue and bring it to a successful conclusion.

SYMPOSIUM ON REINFORCED CONCRETE

A SYMPOSIUM on 'Reinforced Concrete in India To-day', is to be held at Roorke, under the auspices of the Central Building Research Institute, during November 11-13, 1953. The Organising Committee invites engineers, scientists, designers and contractors, to take part in the symposium. Those contributing papers are requested to send a summary of the same to the Director, Central Building Research Institute, before August 15th, 1953. The envelope should be marked clearly "SYMPOSIUM". A detailed list of subjects to be discussed at the symposium can be had on request.

GLUTAMIC ACID AS AN INDUSTRIAL CHEMICAL

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GLUTAMIC ACID has been known to students of protein chemistry for nearly a century, but it emerged out of the laboratory and became a chemical of commercial importance only in recent times. At present the production of glutamic acid amounts to millions of pounds annually. In 1948, the production in the U.S.A. of sodium glutamate was 6·2 million pounds, while the installed plant capacity was estimated at twice this figure.[1] Before World War II, Japan, which was the chief centre of production, manufactured about 9 million pounds; smaller quantities appear to have been produced in China also. Most of the production goes into the manufacture of processed foods, where it is utilised for its remarkable property of stabilising natural flavours.

Glutamic acid, $HOOC.CH_2.CH_2.CH(NH_2).COOH$, was discovered[2] by the German chemist, Ritthausen, in 1866, who isolated it from an acid hydrolysate of gliadin, the alcohol-soluble protein of wheat. The flavour and taste enhancing properties of glutamic acid were discovered by the Japanese chemist, Ikeda, who in 1908, found that the essential constituent of a certain sea-weed, *Laminaria japonica*, extensively used in Japan as a condiment was glutamic acid. Manufacture of the amino acid was begun in Japan under a patent dated 21st April 1909, and under trade names such as "Ajinomoto" (literally, enhancer of taste), glutamic acid became a common household article like salt and sugar.[3] Considerable quantities were imported into America where interest in its production developed in the twenties. Much research and developmental work was found necessary before glutamate manufacture was established in the U.S.A. In addition to the fabrication of new corrosion-resistant materials for use with concentrated hydrochloric acid, this work also resulted in a new process which involved alkaline hydrolysis of beet-sugar molasses.[4]

Occurrence and Physiology

Glutamic acid occurs in combination in practically every protein. The richest sources are given in Table I.

The amino acid occurs in proteins in the form of its acid-amide, glutamine.[5] The raw materials used for manufacture both in the East and in the U.S.A. are wheat and corn gluten from starch factories. Some quantity is also produced in the U.S.A. from beet-sugar molasses. Beet contains 0·06–0·12 per cent. of the amino acid, the entire quantity of which is ultimately found in the de-sugared molasses known as "Steffens waste water".

TABLE I

Glutamic acid content of some proteins[22]

Source	Protein	Glutamic acid %
Wheat gluten	Gliadin	42·2
,,	Whole	36·0
Corn gluten	Zein	36·0
,,	Whole	24·5
Milk (Cattle)	Casein	22·0
,,	Lactoglobulin	20·0
Peanut	Arachin	21·0
Cottonseed	Globulin	17·2
Hemp-seed	Edestin	17·7
Blood (Cattle)	Albumin	17·0
,,	Fibrin	15·0
Muscle	Myosin	21·0
Soya-bean	Whole meal	18·4

TABLE II

*Approximate glutamic acid content of some oilcakes**

Oilcake	Glutamic acid %
Groundnut	7·8
Cottonseed	7·5
Hemp	6·4
Sunflower	5·2
Castor	5·6
Cocoanut	5·0
Linseed	3·8

* Values calculated from the protein and glutamic acid content given in (21) and (22) of bibliography.

The mammalian organism is capable of synthesising glutamic acid, and for this reason, it is not one of the "essential" amino acids which have to be supplied by dietary protein. This fact is, however, definitely established only for certain species such as the rat. Chicks and probably humans require an external supply of glutamic acid for growth.[8,9]

Glutamic acid plays a central role in intermediary protein metabolism on account of the many reactions it is capable of undergoing.[10] The fact that most food proteins contain glutamic acid as a major constituent cannot be without significance.

A special function of glutamic acid is that it is the only amino acid which is oxidised in the brain.[11,12] It is not known whether this property has any connection with its therapeutic use in the treatment of mental deficiency. It has been demonstrated by groups of workers headed by Zimmerman and Waelsch that the mental power of retarded children and adolescents is greatly improved by administration of glutamic acid.[13,14]

Use as Food Flavour

The emergence of glutamic acid as an industrial chemical is not due to its biochemical functions or therapeutic action, but to its widespread use as a food flavour. Mono-sodium glutamate is used extensively as a condiment for enhancement of taste and flavour. Due to its balancing and blending effect it is added as an adjuvent in meats, sea-foods, soups and chowdars. The conclusion from the work of more than one taste panel[16,17] is that monosodium glutamate not only combines all the four components of taste but gives, in addition, a tingling sensation which has been described as a "feeling of satisfaction". A remarkable property of glutamate is its seasoning and blending effect, rounding off sharp profile and suppressing certain undesirable qualities such as the sharpness of onions, rawness of vegetables, volatile characteristic of boiled rice and bitter tastes in certain other dishes. It is estimated that in the U.S.A. 2 million pounds are used in canned soup, an equal quantity in canned meat products, one million pounds in dry soups and one million pounds directly in restaurants. Some quantity is used in the beer industry also. There are indications that the armed forces are likely to be one of the important users of glutamic acid in the future. The monotony of military rations under field conditions is a serious problem and the Food Acceptance Branch of the U.S. Army has been keenly interested in research on glutamic acid with a view to its incorporation in canned rations.

Manufacture

The preparation of glutamic acid in the laboratory is simple. A protein rich in the amino acid, usually wheat gluten, is hydrolysed with concentrated hydrochloric acid, the hydrolysate concentrated to a thin syrup and saturated with hydrochloric acid gas in the cold. Crystallisation of glutamic acid as the hydrochloride is almost quantitative after about 48 hours in the cold. In Japan, this process was used on an industrial scale, the high grade chemical stoneware manufactured in the country serving as a suitable corrosion-resistant material for the construction of equipment. The raw materials used were wheat glutten and soya-bean meal.

The major portion of the U.S.A. production of glutamic acid is from corn gluten which is a by-product in the starch industry. A considerable portion is also produced from concentrated Steffens Waste, obtained by lime treatment of beet molasses, in which the amino acid is present to the extent of about 7·5 per cent. of the total solids.[18]

Possibilities of Manufacture in India

Press cakes of oilseeds are generally rich in proteins with a high content of glutamic acid (Table II) and any one of several oilcakes available in India can serve as a cheap raw material for the manufacture of glutamic acid, and incidentally, of other amino acids, as by-products, which have uses in the laboratory and in the pharmaceutical industry. Thus groundnut and cottonseed cake have about the same content of glutamic acid as the soya-bean meal much used in Japan as a raw material of this process.

Recent developments[19] in the field of corrosion-resistant material have removed the chief difficulties in the use of concentrated hydrochloric acid for hydrolysis of oilcake protein and the isolation of glutamic acid as the hydrochloride. Specially noteworthy is the fabrication of hydrochloric acid-resistant equipment from carbon or graphite rendered impervious by synthetic resins. The use of these materials sold under such trade names as "Karbate" and "Impervite" have made the handling of concentrated hydrochloric acid easy and its recovery economical. With cheap raw material available, it should be possible to establish a flourishing glutamic acid industry in India which would supply the material not only for consumption in the country but also for export.

The author is indebted to Dr. M. Damodaran for the benefit of discussion and advice.

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NEW TYPE OF PENICILLIN

A SPECIES of Cephalosporium has been found to produce two different kinds of antibacterial substances. The first consists of a group of acidic antibiotics which are soluble in common organic solvents, are active mainly against gram-positive organisms, and show similarities to helvotic acid. The second consists of a substance (or group of substances) which is insoluble in most organic solvents, and is active against a number of gram-positive and gram-negative organisms. This has been called 'Cephalosporin N'. Evidence has now been obtained that cephalosporin N is a new type of penicillin.

The reasons for believing that the antibiotic is a penicillin are: (1) It was inactivated by preparations of the enzyme penicillinase in high dilution, and, like benzyl-penicillinase, it stimulated the adaptive production of penicillinase by suspension of *Bacillus cereus*. (2) It was rapidly inactivated at room temperature in aqueous solution below p_H 4 or above p_H 9, and also at p_H 7 in the presence of heavy metal ions such as those of copper, lead and tin. (3) Various chemical reactions yielded thiazolidine hydrochloride, penicilline hydrochloride, penicillaminic acid and glyoxal *bis*-2 : 4-dinitrophenyl hydrazone.

Cephalosporin N differs strikingly from the common penicillins in its hydrophillic character and its anti-bacterial activity. It behaves like an acidic substance on ion-exchange resins, and ionophoresis on paper shows that it carries a negative charge at p_H 6-7. Also it appears likely that the activity of pure cephalosporin N against many gram-negative bacteria will be of the same order as that of benzylpenicillin. The relatively low activity of the antibiotic against gram-positive bacteria suggests that it reaches the sensitive parts of these organisations much less readily than the other penicillins.—(*Nature*, 1953, 171, 343.)

'DARAPRIM' IN TREATMENT OF VIVAX MALARIA

THE effects of pyrimethamine ("daraprim") on the clinical symptoms and also on the parasites in 30 cases of vivax malaria attending hospitals in Delhi State are reported by Jaswant Singh and collaborators of the Malaria Institute of India in a recent issue of the *British Medical Journal*. The clearance of symptoms and asexual parasites was more rapid in those who had a previous history of malaria than in those who had not. Though one must withhold judgment until reports on a large-scale and continued observations are available, daraprim seems to be remarkably effective against *P. vivax* in doses as small as 25 mg. The drug in all probability has a future and further work is indicated.

It may be mentioned that more recent reports from the U.S.A. show that the drug has gone through laboratory and field tests and found to be an anti-malarial of unusual scope and potency—perhaps the most effective agent discovered so far for the cure and suppression of malaria. It is claimed that the drug is 10 to 200 times as active as chloroquine, proguanil and mepacrine, the standard drugs in use at present for the treatment of malaria. It is reported that a 50 mg. dose of 'daraprim' is often sufficient to control the fever in acute malarial attacks and render the blood free from most strains of the disease, and that there are no after-effects.

COMMONWEALTH INDEX OF SCIENTIFIC TRANSLATIONS

THE British Commonwealth Scientific Liaison Offices in London are operating a scheme for a Commonwealth Index of Scientific Translations, and have appointed so far seven agencies in the Commonwealth countries. These agencies act in a liaison capacity and are responsible for collecting information about existing translations in that area for advising BCSO, London, of these, for the maintenance of a central index of translation as also for assisting research workers in each area to obtain copies of translations requested by them and already prepared elsewhere. Scientific organisations are invited to participate in the scheme and to get into touch with the Ministry of Natural Resources and Scientific Research, New Delhi, who hold the agency for our country.

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ON EQUALLY-CORRELATED STATIONARY PROCESSES

A discrete real stationary time series consists of a sequence of real numbers ordered in time, one observation corresponding to each of equally spaced time instants (denoted here by the integral variates n and s), obtained from populations $\{x(n)\}$ subject to (i) $E\{x(n)\} = m$, a constant independent of n and (ii) $E[\{x(n+s) - m\}\{x(s) - m\}] = R(n)$, a function of n only. An equally correlated process is a particular case, when

$$R(n) = \begin{cases} \rho^2 \text{ for } n = 0 \\ \rho^2 c \text{ for } |n| = 1, 2 \cdots p\ (|c| \leq 1) \\ 0 \text{ otherwise} \end{cases}$$

That equally correlated stationary processes exist is easily seen. For such processes, the authors have proved the following:—

Theorem I.—The spectrum is absolutely continuous and is given by

$$\tfrac{1}{2}\pi\,[1 + c\{e^{i\lambda} + e^{-i\lambda} + e^{2i\lambda} + e^{-2i\lambda} + \cdots + e^{pi\lambda} + e^{-pi\lambda}\}]$$

Theorem II.—The Hilbert space of the process is linearly non-deterministic, i.e., $x(n)$ cannot be fully linearly represented in terms of $x(n-1)$, $x(n-2)$, ... *ad inf.*

Theorem III.—The process cannot be Gaussian.

Theorem IV.—If observations are confined to $(p+1)$ consecutive ones, their arithmetic mean forms the best linear unbiassed estimate of m.

Andhra University, Waltair, *May* 13, 1953.

K. Nagabhushanam.
V. K. Murthy.

A MODIFICATION OF THE MODEL 50 PULSE GENERATOR

THE model 50 pulse generator described by Elmore and Sands[1] was built in this laboratory for testing standard electronic equipments used in nuclear physics experiments. However, in the final output stage, this was found to deliver a very large negative 'kick-back' along with the desired flat-topped positive pulse. Hence the modified circuit shown in Fig. 1 was designed in which a double diode limiter of the series-shunt type has been employed to cut off the positive overshoot at the input grid of T_4. This stops the negative 'kick-back' at the output of T_4, which is due to the amplification of the positive overshoot at its input.

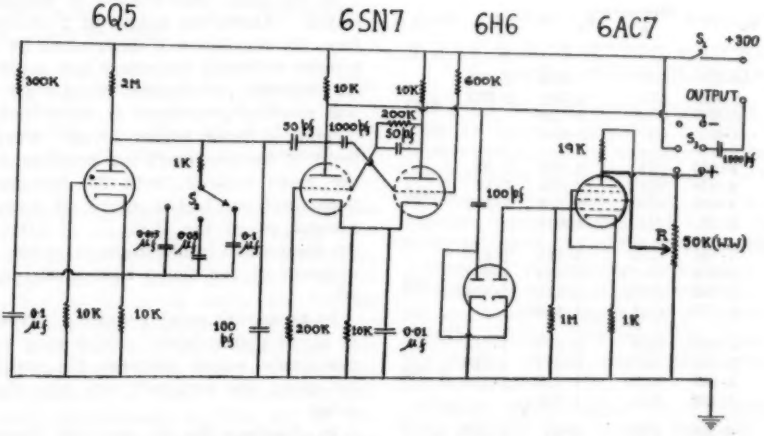

FIG. 1. Circuit Diagram of Pulse Generator

Either negative or positive pulses can be obtained from this circuit by means of a selector switch S_2. Both positive and negative pulses are flat-topped with a sharp rise. The flat portion of each pulse is of 250 μ sec. duration and the decay time is 100 μ sec. The negative pulses have a constant height of 100 volts, while the positive pulses of adjustable height can be obtained by varying the potentiometer R, the range being 0–80 volts. However, in the low voltage region, approximately below 4 volts, the flat top of the pulse is accompanied by a very small kink. Efforts are being made to improve the pulse shape in the low voltage region. Different repetition rates can be obtained by means of the selector switch S_2.

This pulse generator has been used satisfactorily in this laboratory for calibrating pulse amplitude discriminator.

The authors are indebted to Dr. S. N. Ghoshal for his interest and guidance. They are also indebted to the Atomic Energy Commission and to the Scientific Research Committee of U.P. for the award of scholarships.

Physics Department, T. N. DAVE.
Lucknow University, A. N. SAXENA.
April, 1953.

1. Elmore and Sands, *Electronics*, Chapter 6, p. 320, McGraw Hill.

FORCE CONSTANTS OF CERTAIN DIATOMIC MOLECULES

RECENTLY Walsh[1] has plotted the force constant of a diatomic molecule formed between a group IV element (A) and a group VI element (B) against the force constant of the molecule formed between the same group IV element (A) and the group VII element (X) of atomic number greater by unity than that of (B). He has obtained a straight line passing through the origin for all the elements of the group IV, indicating that the two force constants are proportional independent of the fact that which group IV element forms the molecules. No numerical verification of the relation has been given by Walsh. However, a closer examination of the available data reveals that the ratio depends on the group IV element as shown in Table I. This ratio can be used for predicting the force constant of one such molecule, if the force constant of the other corresponding molecule is known. For completeness, the predicted values of five molecules of the series are also given in the same table marked with stars). K_e is the force constant given by $4\pi^2\mu c^2\omega_e^2 = 5{\cdot}8883 \times 10^{-2}\mu\,\omega_e^2$ dyne/cm., where the symbols have their usual meanings. The data for CF and CTe

has been taken from Rosen's *Donnés Spectroscopiques concernant les Molécules Diatomiques* (1951) and for the other molecules from Herzberg's *Molecular Spectra and Molecular Structure*, Vol. I (1951). The value for CTe is only approximate, and hence the predicted value for CI is also not very reliable. R denotes the ratio $K_e(AB)/K_e(AX)$.

TABLE I

Molecule AB	$K_e \times 10^{-5}$	Molecule AX	$K_e \times 10^{-5}$	R	Mean R
CO	19·02	CF	7·406	2·568	2·41
CS	8·488	CCl	3·766	2·253	
CSe	6·586	CBr	2·733*		
CTe	~4·95	CI	~2·05*		
SiO	9·246	SiF	4·892	1·89	1·887
SiS	4·938	SiCl	2·624	1·88	
SiSe	4·094	SiBr	2·214	1·892	
SiTe	3·13	SiI	1·66*	..	
GeO	7·526	GeF	3·925	1·917	1·896
GeS	4·359	GeCl	2·323	1·877	
GeSe	3·743	GeBr	1·971	1·894	
GeTe	2·776	GeI	1·464*	..	
SnO	5·615	SnF	3·277	1·713	1·759
SnS	3·536	SnCl	1·977	1·789	
SnSe	3·063	SnBr	1·726	1·775	
SnTe	2·439	SnI	1·386*	..	
PbO	4·556	PbF	2·63	1·732	1·777
PbS	2·992	PbCl	1·627	1·84	
PbSe	2·594	PbBr	1·449	1·79	
PbTe	2·086	PbI	1·194	1·747	

While the variation of this ratio R is not regular as we pass from C molecules to Pb molecules, it is found that the behaviour is very similar to the ionization potential V of the IVth group elements. As a matter of fact, $R \propto V^{3}/_{4}$ The constancy of the ratio $R/V^{3}/_{4}$ is shown in Table II.

TABLE II

Group IV element	R	V	$R/V^{3/4}$
C	2·41	11·265	·392
Si	1·887	8·149	·391
Ge	1·896	8·126	·394
Sn	1·759	7·332	·395
Pb	1·777	7·415	·395

The author is grateful to Dr. K. Majumdar for his guidance in the work.

Dept. of Physics, YATENDRA PAL VARSHNI.
Allahabad University, Allahabad,
April 22, 1953.

1. Walsh, A. D., *Proc. Roy. Soc.*, 1951, **207A**, 13.

REMARKS ON A NOTE ON "DEVELOPMENT OF NOR'WESTERS ETC."

IN the above note,[1] the authors state that "from the above, the authors are tempted to conclude that the advection of colder air between 10,000′ and 20,000′ and possibly also between 20,000′ and 30,000′ appears to be the *final determining factor* in the outbreak of nor'westers, at least when they are widespread".

In my note, 'Nor'westers in Bengal',[2] I have stated: "Above the height of 2 or 3 km., as before, the circulation is determined by the rear of a more northerly secondary low pressure area of the western disturbance. Colder air than what was existing previously at those levels must be flowing at those higher levels. When the 'cold front' of the secondary low pressure area reaches the given locality, both the favourable conditions and an initial cause of convection are present as in the U.P....." after discussing the theoretical implications of earlier work. The diagram of the above note is also quite explicit.

In an earlier note[3] I stated: "Fresh incursion of air at higher levels, colder than what existed previously would decrease the stability in the air along the vertical" (*cf.* also Fig. 2 of the note).

In Abstract No. 37, *Ind. Sci. Congress* (1937 Mathematics and Physics Section), I stated, "As the thermal distribution is not inherently unstable on days of thunderstorms, the causes that would initiate convection have been considered.....Thunderstorms occur when the air at 2-4 km. is replaced by air potentially colder than what existed there previously....."

In a paper entitled 'Dynamics of Thunderstorms',[4] I stated: "From a practical point of view, the above discussion leads one to the useful conclusion in the case of heat thunderstorms: if at higher levels fresh air which is relatively cooler or potentially cooler than the one existed before.....the conditions become favourable for thunderstorms".

The above earlier conclusions and references on the subject seem to have escaped the authors. In addition, I wish to point out that in 'Mechanism of Thunderstorms in the Tropics',[5] where I have summarised most of my conclusions (the main data used were about nor'westers from isopleths drawn about cold pools of air at lower levels for the period 11th-16th March 1947). I have stated (p. 163), *"Favourable air structure.*—The rate of rise of potential temperature with height can be made small if one or both of the following two contingencies occur. (*a*) An incursion of colder or potentially colder air takes

place at levels from 3-6 km.....An incursion of potentially colder air is possible if fresh air from a more northerly latitude is brought". The stress throughout the paper is for *advection currents* of fresh, cold and warm air masses. The diagram 2 *b* (p. 177) also shows it. Quite a number of other factors that enter into the pictures have also been discussed, may be with the use of the then available data but which merit reference.

Colaba Observatory, S. L. MALURKAR.
Bombay-5, *April* 30, 1953.

1. Ramaswamy, C. and Bose, B. L., *Curr. Sci.*, 1953, **22**, 103. 2. Malurkar, S. L., *Ibid*, 1949, **18**, 5. 3. —, *Ibid.*, 1948, **17**, 348. 4. —, *Proc. Ind. Acad. Sci.*, 1943, **18A**, 20. 5. —, *Proc. Nat. Inst. Sci. Ind.*, 1949, **29**, 162.

IT is common knowledge among meteorologists that advection of colder air at high levels produces conditions favourable for thunderstorms. Mr. Malurkar has no doubt mentioned this in his papers but, as far as we are aware, he has nowhere proved by adducing synoptic and aerological evidence on specific dates that this upper level condition was actually responsible for the nor'westers, or that it was associated with western disturbances moving far to the north of India. We may also point out that the isopleths mentioned in the last para of his letter are in respect of *surface* temperatures and not upper air temperatures and that the diagram 2 *b* referred to by him is only a schematic diagram bearing no reference to the aerological situation on any particular day.

It is relevant to point out in this connection that we have brought out in our article, the following two points :—

(*a*) We have advocated the use of a ready and simple technique for detecting the advection of colder air over northern India and Pakistan during the nor'wester season.

(*b*) Using this simple technique on a number of specific occasions of widespread nor'westers and nor nor'westers, we have tried to give convincing proof of the advection of colder air between 10,000′ and 30,000′ on the days of nor'westers and suggested on the basis of this evidence that the upper level advection is probably the *final determining factor* in the development of nor'westers.

It is not correct to say that our investigations are based on data which were not available earlier. Our technique of analysis is based mainly on routine upper wind data which have been merely rehashed into a new form by means of a polar diagram.

Notwithstanding the above, we are thankful to Mr. Malurkar for specially drawing our attention to his papers and would assure him that they will be duly included in the list of references in our paper which will be published elsewhere.

Meteorological Office, C. RAMASWAMY.
Calcutta Airport, B. L. BOSE.
Dum Dum, *June* 12, 1953.

X-RAY DIFFRACTION AND ELECTROLYTIC DISSOCIATION

THE study of progressive dissociation of electrolytes in aqueous solutions by the method of X-ray diffraction in liquids was proposed for the first time by R. S. Krishnan[1] in his investigations on sulphuric acid and sulphates at different concentrations. From a comparative study of the X-ray diffraction patterns, he concluded that the stepwise dissociation of sulphuric acid was responsible for the observed effects. He also observed the X-ray diffraction effect in $KHSO_4$ solution but made no observation on the change of the degree of dissociation with concentration.

Raman effect studies[2] in concentrated solutions indicate that normal salts are completely dissociated at all concentrations and that in strong acids and acid salts, the degree of the dissociation increases with dilution.

X-ray diffraction pattern of aqueous solutions of $NaHSO_4$ at various concentrations as well as in the powder state have been investigated using the CUK_α radiation and powder photograph method. A remarkable series of photographs has been obtained which portray all the changes taking place from the solid state to a state of very dilute solution in a very vivid manner. For instance, in very concentrated solutions $NaHSO_4$ forms a ring of its own which is slightly greater than the water-ring and corresponds roughly to the average spacing for the powder pattern. As the dilution increases, the ring becomes smaller and broader, the edges becoming more and more diffuse. At a concentration of N/2, no definite halo is obtained but only a corona surrounding the central spot, the diameter of the edge of the corona corresponding roughly to the outer edge of the water-ring. With further dilution the halo reappears, the maximum of which coincides with that of water in very dilute solutions.

The diffraction patterns in concentrated solutions have been interpreted as mainly due to the rearrangement of the water molecules in the

electric field of the ions,[3] these being too light to contribute appreciably to the diffraction pattern themselves. The results are fully in accord with other observations[4,5] in solutions that the addition of the small ions in general produces greater regularity in structure and X-ray diffraction pattern resembles closely the universal pattern of a close packed liquid.[6]

The changes in the diffraction pattern with increasing dilutions have been explained on the basis of the two-stage dissociation of $NaHSO_4$, *viz.*,

$$NaHSO_4 \longrightarrow Na^+ + HSO_4^-$$
$$HSO^-_4 \longrightarrow H^+ + SO_4^{--}$$

An attempt has been made to correlate the results with those obtained from Raman effect studies.

Investigations are in progress on other acids and salts, and some very interesting results have been obtained. The details will be published elsewhere.

Physics Dept., P. N. SHARMA.
Lucknow University, S. N. DUTTA.
May 20, 1953. S. R. BHATTACHARYA.

1. Krishnan, R. S., *Proc. Ind. Acad. Sci.*, 1937, **4**, 661. 2. Hibben, "The Raman Effect and Its Chemical Applications" (*American Chemical Society Monograph Series No.* 80), 1939. 3. Bernal, J. D. and Fowler, R. H., *J. Chem. Phys.*, 1933, **1**, 515. 4. Meyer, H. H., *Ann. Der. Phys.*, 1930, **5**, 701. 5. Ganesan, A. S. and Venkateswaran, S., *Ind. J. Phys.*, 1929, **4**, 195. 6. Prins, J. A., *J. Chem. Phys.* 1935, **3**, 72.

RADIOACTIVITY OF CHARNOCKITES AND THEIR PETROGENESIS

THE controverted problem of the petrogenesis of charnockites has been studied by several research workers of the Geology Department of the Andhra University since 1945 in the light of their petrography and petrochemistry. An attempt is made in the course of this note to examine the problem from a new angle—the radioactivity distribution.

Twenty-two representative samples of charnockites and associated rocks, drawn from Ananthagiri, Kondapalli, Pallavaram and Trichinopoly areas, which are roughly spaced at intervals of about 200 miles, were examined for their radioactivity. The consolidated data is presented in the following table in the order of decreasing radioactivity (in terms of equivalent uranium content in grams of U per gram of rock).

When this data is studied in conjunction with relevant geological information, it is found that the radioactive content of a rock suite of a particular area is intimately related to the petrogenetic history.

	Average radioactivity of charnockites	Highest radioactivity associated with acid charnockites	Highest radioactivity associated with leptynites
A	$17{\cdot}654\times10^{-6}$	$37{\cdot}27\times10^{-6}$	Not determined
P	$12{\cdot}813\times10^{-6}$	$36{\cdot}78\times10^{-6}$	$22{\cdot}77\times10^{-6}$
T	$8{\cdot}523\times10^{-6}$	$25{\cdot}68\times10^{-6}$	$12{\cdot}84\times10^{-6}$
K	$6{\cdot}002\times10^{-6}$	$10{\cdot}75\times10^{-6}$	$7{\cdot}60\times10^{-6}$

A—Ananthagiri area, Visakhapatnam District; P—Pallavaram area, Madras; T—Trichinopoly area; K—Kondapalli area, Krishna District.

In the Ananthagiri area, the manifestations of the processes of granitisation are clearly discernible.[4] Felspathisation, which may be taken as a particular case of granitization, appears to have markedly influenced the mineralogical constitution of the rocks of this area. That these processes had been all-pervasive is borne out by the relatively higher content of micas and amphiboles even in the basic rocks, which suggests that their normal constitution has been modified to some extent by the later hyperfusible constituents. The granitic ichor, rich in radioactive constituents, slowly rises into the superposed rocks and diffuses the radioactive material into the surrounding zones.[3] According to Bugge,[2] the radioactive elements are often mobilized in remelting and migrate in the ichor, which is capable of moving to distances ranging from a few millimetres to several kilometres. The petrogenetic history of the Ananthagiri charnockites is thus reflected in the high radioactivity associated with them, both individually and collectively.

At Kondapalli, the basic and ultrabasic varieties of charnockites form a sizable proportion of the total charnockitic rocks.[7,8,9] The association of chromite, as well as the mineralogical and chemical composition of the basic and ultrabasic varieties are clearly suggestive of their predominantly igneous origin, as differentiation products of a basic magma. The magma, which had given rise to these rocks, appears to have been poor in hyperfusible constituents to start with, as is suggested by the low radioactivity of even the acid charnockites of this area. It is, therefore, not surprising that a group of rocks with such a petrogenetic history as Kondapalli charnockites should be characterized by low radioactivity.

The chief interest of Pallavaram[1,5,6] and Trichinopoly groups of charnockites lies in the fact that they show evidence of both magmatic

differentiation and granitization. In keeping with this field evidence, their radioactivity is intermediate between the Ananthagiri and Kondapalli groups of charnockites. The radioactivity of Leptynites shows the same alignment as exhibited by charnockites and thus constitutes additional evidence to support the surmises made earlier.

From these observations, it appears that the study of the radioactivity of charnockites gives a valuable clue to its genetic history and that a charnockitic group with low radioactive content may be indicative of the possibilities of occurrence of economic minerals like chromite.

A detailed paper with full data and technical information is being published by one of us (U. A. N.).

This work was carried out under the ægis of the Council of Scientific and Industrial Research Scheme in progress in the Geology Department.

Geology Dept., C. MAHADEVAN.
Andhra University, U. ASWATHANARAYANA.
Waltair, *May* 28, 1953.

1. Bhaskara Rao, A., *M.Sc. Thesis, Andhra Univ.*, 1950. 2. Bugge, A. W., *Avhandl. Norske Videnskaps, Akad. Oslo I Mat. Natur. Klasse*, 1945, No. 13. 3. Eskola, P., *Mineralog. u. Petrog. Mitt.*, 1932, **42**, 455. 4. Kukkuteswara Rao, B., *M.Sc. Thesis, Andhra Univ.*, 1951. 5. Rajagopalan, C., *Proc. Ind. Acad. Sci.*, 1946, **24**, 315. 6. —, *Ibid.*, 1947, **26**, 237. 7. Srirama Rao, M., *Ibid.*, 1946, **24**, 199. 8. —, *Ibid.*, 1947, **26**, 133. 9. Venkatappayya, N., *M.Sc. Thesis, Andhra Univ.*, 1947.

ON THE ROLE OF IRON IN STREPTOMYCIN FORMATION BY *S. GRISEUS*•

IN previous communications[1,2] the high streptomycin production by *S. griseus* when grown in an aqueous extract of wheat bran was shown to be due to its mineral content. The results of further experiments on various elements present in the bran extract ash are presented below.

The proximate analysis of the bran extract ash showed it to contain the following elements: K, Ca, Mg, Al, Na, Fe, Cu and Mn. To get a qualitative idea regarding the role of elements on streptomycin production, the following procedure was adopted. To a basal medium in which streptomycin production was negligible the various elements were added, the addition being made such that the effect, if any, of each element could be easily made out. The experimental methods for culturing the organism for estimating the streptomycin titre, etc., were the same as those previously described.[3] The results of these studies are presented in Table I. Cu has been added in the form of $CuSO_4$, $5\,H_2O$, Mg as $MgSO_4$, $7\,H_2O$, Fe as $FeCl_3$. $6\,H_2O$ and Al as alum.

TABLE I

	Composition of medium	Streptomycin titre	Days after inoculation
1	Basal medium (B.M.)	20	..
2	B.M. + Cu 0·26	15	..
3	B.M. + Cu 0·26 + Mg 5·0	15	..
4	B.M. + Cu 0·26 + Fe 0·06	72	7, 8
5	B.M. + Fe 0·06 + Al 3·0	72	7, 8
6	B.M. + Fe 0·06 + Cu 0·26 + Al 3·0 + NaCl 1·5	92	7, 8

• Quantities mentioned in column 1 are in mg. per 100 ml. of B.M.

It is clear from the table that of the elements added, only iron has marked influence on the streptomycin production. The effect observed on adding sodium chloride had been reported earlier.[1]

The effect of varying amounts of iron on streptomycin was next investigated. Different amounts of iron were added to basal medium and antibiotic production studied. The results are presented in Table II.

TABLE II

Amount of Fe in mg./100 ml.	Maximum streptomycin titre	Day after inoculation
Nil	15	..
0·125	68	8, 9
0·250	75	8
0·500	93	0
0·600	98	8
0·700	108	8
1·000	110	8

The remarkable effect of small quantities of iron on streptomycin formation is obvious, about 0·7 mg. per 100 ml. of the basal medium being optimum.

Iron, therefore, appears to be the element present in bran extract ash which stimulates streptomycin production by *S. griseus*.

The author is indebted to Dr. V. Subrahmanyan for his interest, and the C.S.I.R. for financial support.

Dept. of Biochemistry, R. RAGHUNANDANA RAO.
Medical College, Trivandrum,
February 23, 1953.

1. Raghunandana Rao, R., *Nature*, 1948, **162**, 820. 2. —, *Ibid.*, 1948, **162**, 850. 3. —, *Ibid.*, 1946, **158**, 241.

• Part of thesis submitted for the Ph.D. Degree.

MICRO-ELECTROPHORETIC STUDY OF SERUM PROTEINS FROM NORMAL AND MALARIAL CHICKEN (INFECTED WITH *PLASMODIUM GALLINACEUM*)

THE determination of the proteins in the blood serum by electrophoresis has attained great importance[1] and electrophoretic studies of chicken serum proteins under diverse conditions have been reported in the literature.[2-6] Work has been carried out in these laboratories by one of the authors (R. R.) to find out the protein levels by salt fractionation technique[7] in normal and malarial chicken. The electrophoretic investigation was undertaken to confirm and extend the above study and to elucidate the presence of new components, if any.

Chicken of the white leghorn breed from 12-15 weeks of age were used for the experiment. They were kept in individual cages and fed with the laboratory standard diet. Birds were usually made to fast 24 hours previous to taking blood. Blood was taken from individual birds by cardiac puncture and allowed to clot. Serum was obtained by mild centrifugation. After getting the normal serum the same birds were injected intramuscularly with 16×10^6 parasites. Blood from parasitised birds was taken and serum was prepared. Each sample of the serum obtained was generally diluted with four times its volume with Michaelis buffer[8] (pH 8·6, ionic strength 0·1). The diluted serum was dialysed for a period of 40-70 hours against 250 ml. of buffer using cellophane bags. The electrophoresis was carried out in Kern's micro-electrophoresis apparatus[9] at the room temperature (25° ± 2° C.). Field strengths of 4-6 volts per cm. were employed and the fractionation was over within 60 minutes. The ascending and the descending interferometric electrophoresis patterns of normal and malarial serum are given in Figs. 1 and 2.

Calculations were made from the descending patterns after plotting the curves as given by Lebhard.[10] The relative composition of the various fractions has been calculated from the curves obtained. The mobilities have been determined from the mean position moved by each fraction.[11] The initial and final temperatures in the open limb of the buffer were read and conductivities were calculated at the average temperature by applying 2 per cent. correction for each degree rise in temperature. The results of this investigation are presented in Table I.

TABLE I

Mobility and relative composition of chicken serum proteins under normal and pathological conditions*

Fraction	Normal		Normal (Sanders)[6]		Malarial (average 43% parasites)	
	Average percentage composition	Mobility at 25° C.	Average percentage composition	Mobility at 0° C.	Average percentage composition	Mobility at 25° C.
Albumin	59·3	14·7	57·9	5·7	40·5	14·5
α_1 ..	4·5	12·64	15·5	4·5	6·0	12·2
α_2 ..	9·0	10·0			11·1	9·5
β ..	13·0	6·1	9·3	3·5	14·6	5·9
γ ..	14·3	2·2	17·2	1·9	28·0	2·8

* Mobilities are given in $\times 10^{-5}$ cm.^{2} volt^{-1}/sec.$^{-1}$

From the results presented in the above table, it is clear that there is a marked change in the total protein as well as in the albumin and γ-globulin fractions in serum proteins of the chick having a very acute malarial infection. The average value of the total protein concentration has decreased from 3·97 g./100 ml. to 2·61 g./100 ml.

It is further clear from the above pattern that there is no formation of a new component

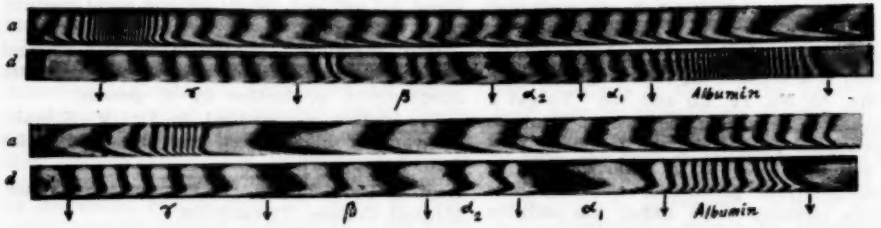

FIG. 1

FIG. 2

FIG. 1.—A typical interferometric electrophoretic pattern of normal chick serum protein in Michælis buffer, $\mu = 0{\cdot}1$, pH = 8·6. Dilution 1 : 3. Experiment carried out for 50 minutes under 64·0 volts × 4·2 milliamperes. *a*: ascending pattern, *d*: descending pattern.

FIG. 2.—A typical interferometric electrophoretic pattern of malarial chick serum protein under the above experimental conditions. Dilution 1 : 4. Experiment carried out for 60 minutes under 55 volts, × 3·75 milliamperes. *a*: ascending pattern, *d*: descending pattern.

in the serum from the malarial chick. The decrease in the albumin moiety as well as the increase in globulins is due to the liver and kidney damage. The increase in the γ-globulin content may be due to the probable immunological response of the chick on account of infection. Besides these, there are no other marked changes in α_1, α_2 and β-globulins. The mobilities of the various components did not show any major changes in the pathological condition. Our findings are in agreement with the general nature of changes in serum protein concentration (salt precipitation techique) reported by others[12,13] in malarial infections met with in man and monkeys.

Since malarial parasite is an intracellular organism it is expected that a study of the red cell protein[14] in the normal and pathological condition along with the present study will give us a complete picture of the changes likely to occur in whole blood. This study is in progress and will be reported in future communication.

The authors wish to thank Drs. K. V. Giri, M. R. Aswathanarayana Rao, K. P. Menon and A. S. Ramaswamy for their kind interest in the work.

Pharmacology Lab., Dept. of Biochemistry, and Dept. of General Chemistry, Indian Inst. of Sci., Bangalore-3, *March* 20, 1953.

R. Rama Rao.
M. A. Cohly.

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ESTIMATION OF PHOSPHORUS IN SOILS BY COLORIMETRY

Various analysts have been working on the application of colorimetry for the determination of phosphoric acid in soils employing the molybdenum blue colour obtained by reduction.[1-4]

The soils on which coffee is grown in South India contain appreciable amounts of iron which interfere in the development of the molybdenum blue colour. For such soils, the following modification of the Sherman method has proved successful.

The soil samples (usually 5 g. air-dry sample) are digested as per Piper's[5] method with (50 ml.) constant B.P. hydrochloric acid for one hour, cooled and made up to a known volume (200 ml.). A suitable aliquot depending on the P_2O_5 content of the soil (usually 2 ml.) is taken, in a 25 ml. standard volumetric flask, diluted to approximately 20 ml., 2·5 ml. of 60 per cent. perchloric acid added, followed by 0·8 ml. of 1-2-4-amino naphthol sulphonic acid reagent (0·125 g. of 1 : 2 : 4-amino naphthol sulphonic acid in 44 ml. of 15 per cent. $NaHSO_3$ and 5-7 ml. of 20 per cent. Na_2SO_3)[3] and 2 ml. of a 5 per cent. solution of ammonium molybdate, made up to volume, allowed to stand for 15 minutes and the deflection read off on a colorimeter (EEL portable colorimeter) using a red filter. The P_2O_5 values are read off on a graph previously prepared in which varying quantities of standard K_2HPO_4 are plotted against the deflections observed. A practically straight line graph is obtained.

The following table gives the results obtained with a few samples of soils :—

No.	Soil sample		% Organic matter (organic carbon × 1·724)	% P_2O_5 HCl extract (volumetric method)	% P_2O_5 (perchloric acid extract, colorimetric)	% P_2O_5 (HCl extract, (perchloric acid, colorimetric)
1	2		3	4	5	6
1	Kolarkhan Soil No.	A	1·243	0·150	0·151	0·153
2	,,	B	1·955	0·175	0·169	0·161
3	,,	C	3·740	0·197	0·205	0·200
4	,,	D	..	0·084	0·082	0·081
5	Emmekhan Soil No.	A	4·048	0·096	0·097	0·105
6	,,	B	4·119	0·197	0·178	0·199
7	,,	C	5·114	0·322	0·308	0·318
8	,,	D	2·677	0·110	0·108	0·106
9	,,	E	3·284	0·092	0·085	0·083
10	,,	F	1·782	0·119	0·109	0·107
11	Kummergode soil No.	A	2·891	0·234	0·212	0·230
12	,,	B	3·589	0·147	0·146	0·144
13	,,	C	3·911	0·173	0·171	0·171
14	,,	D	3·693	0·111	0·092	0·106
15	,,	E	3·315	0·176	0·176	0·167

It will be seen from the above that good agreement can be obtained using the colorimetric method for soils with a wide range of organic matter content.

It is possible to use the usual hydrochloric acid extract for determining the P_2O_5 content

of soils by adding 2·5 ml. of 60 per cent. perchloric acid for a final volume of 25 ml. at time of developing of colour with 1-2-4 amino naphthol sulphonic acid and ammonium molybdate. The HCl extract can be used for determining K_2O, etc., thus saving on time and expenditure.

When using an HCl extract with added perchloric acid, the colour developed is constant up to 45 minutes after which the intensity increases. Also there is no effect of chloride ions up to a concentration of HCl which is 2½ times the concentration present in a usual HCl extract of soils at the time of development of colour.

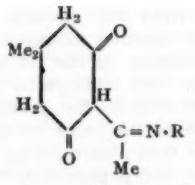
Chemistry Division, N. G. CHOKKANNA.
Ind. Coffee Bd. Res. Stn., L. V. VAIDYANATHAN.
Balehonnur, S. V. KUPPUSWAMY.
March 30, 1953.

1. Snell, F. D. and Snell, C. T., *Colorimetric Methods of Analysis*, 1951, **2**, Third Edn., Van Nostrand, New York. 2. Iyengar, N. G. C. *et al.*, *Curr. Sci.*, **1941, 10,** 438. 3. Sherman, N. S., *Ind. Eng. Chem., Anl. Ed.*, **1942, 14,** 182-35. 4. Hoffman, O., found in Ref. (1) page 661. 5. Piper, C. S., *Soil and Plant Analysis*, 1944, *A.E.A.*, 1931, Provisional Method for Preparing Hydrochloric Extract of Soils. 6. Youden, W. J., *Statistical Methods for Chemists*, 1951, pp. 41-45, John Wiley, New York.

CONDENSATION OF C-ACETYL-METHONE WITH PRIMARY AMINES

DIECKMANN AND STEIN[1] have described an "anilide" of C-acetylmethone. The same anilide as well as "p-toluidide" and "monoamine" of C-acetylmethone have been prepared by Crossley and Renouf.[2] These derivatives were prepared by these authors during a study of C-acetylmethone and were not studied in much detail and the problem of their constitution was not tackled. It has, therefore, been considered worthwhile to study the reaction of C-acetylmethone with primary amines (aromatic and heterocyclic) in detail and to attempt to determine the constitution of the condensation products. With this end in view, C-acetylmethone has been condensed with aniline, p-chloro-, p-bromo, and p-iodoanilines, o- and *m*-toluidines, o- and p-xylidines, α- and β-napthylamines, sulphanilamide, benzidine and 2-amino thiazole.

The condensation products have been characterized as 5, 5-dimethyl-2-(α-arylimino-) ethylcyclohexane-1, 3-diones of the general formula (I).



(I)

The melting points and the physical appearance of the condensation products are tabulated below:

R	m.p. (uncorrected)	Physical Appearance
Phenyl–	132° –2·5°	Colourless long flat needles
p-Chlorophenyl–	156·5°–7·5°	Colourless long prismatic needles
p-Bromophenyl–	158·5°–9·5°	Colourless long prismatic needles
p-Iodophenyl–	150° –1°	Colourless prisms
o-Tolyl–	123° –4°	Colourless prismatic needles
m-Tolyl–	117° –7·5°	Colourless long rectangular plates
o-Xylyl–	118° –8·5°	Colourless clusters of stout prism
p-Xylyl–	155·5°–6·5°	Colourless clusters of plates
α-Naphthyl–	165°	Colourless glistening plates
β-Naphthyl–	184° –5°	Colourless glistening plates
p-Sulphonamidophenyl–	247° –9°	Colourless long rectangular plates
2-Aminothiazolyl–	202° (dec.)	Dark brown solid

Two molecules of C-acetylmethone condensed with one molecule of benzidine to give a crystalline product, m.p. 290°–2°.

The condensation products yielded bis-2 : 4-dinitrophenylhydrazones which did not melt up to 340°.

Full details about this work and investigations about the structure of the condensation products will be reported elsewhere.

Our thanks are due to Dr. Sukh Dev for his helpful suggestions during the course of this work.

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Bangalore-3, *April* 10, 1953.

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VITAMIN A AND ESSENTIAL FATTY ACIDS IN THE PRODUCTION OF CUTANEOUS LESIONS IN RATS

'PHRYNODERMA'—a follicular hyperkeratosis of the skin, is a common manifestation of a deficiency disease prevalent in India. This skin condition has been described occurring in association with xerophthalmia and keratomalacia by Frazier and Hu[1] in China, Loewenthal[4] in East Africa, Nicholls[7] in Ceylon, Radhakrishna Rao[10] in India, Pemberton[9] in England, Lehman and Rapaport[3] in America and Pallister[8] in Malaya. For over a decade, these lesions have been interpreted as pathognomic of vitamin A deficiency, but recent work of Gopalan[2] and Menon[5] *et al.* stress the importance of certain members of vitamin B complex and essential fatty acids.

A review of the literature on the cutaneous manifestations in vitamin deficiency reveals the fact that although in several of the human deficiency syndromes skin lesions are prominent, it is not always clear, however, which nutrient is responsible for the observed changes. Recently, Moult[6] has revealed that keratotic plugs may readily be induced in rats maintained on a vitamin A-free diet and that these plugs are identical with those occurring in human subjects.

The aim of the present investigation was to elucidate the comparative functions of vitamin A and essential fatty acids in maintainig the epithelium of the rat in a normal state and to study the effects of deficiencies of these factors on the structure of the skin.

In the first experiment, albino rats (Haffkine inbred strain) were maintained on diets, the vitamin A content of which ranged from 0-50 I.U. The synthetic diets supplemented with 0-5 I.U. of vitamin A when given to animals, produced hyperkeratinization of the outermost layer of the skin (stratum corneum), together with dilatation and plugging of the hair follicles. The degree of hyperkeratinization and plugging were inversely proportional to the amount of vitamin A in diet.

The second experiment was conducted to study the effect of various fats containing different proportions of essential fatty acids. The animals were maintained on fat-free diet and diets containing various types of fats—vegetable, animal and hydrogenated, supplying different percentages of essential fatty acids. The cutaneous lesions in this experiment, where the fat was deficient in essential fatty acids, resembled very closely those occurring in the previous vitamnin A-deficient experiment. However, the following differences have been observed. Vitamin A deficiency was characterized by hyperkeratinization in which keratin material appeared to be deposited in loose lamellæ. In late stages, atrophy of the lining epithelium of the hair follicles as well as the sebaceous glands, was evident. The

FIG. 1

FIG. 2

FIG. 1. Skin section of a rat on a completely vitamin-A deficient diet, showing marked hyperkeratosis of the hair follicles, dilatation of their funnels by keratotic plugs and atrophy of the lining epithelium of the hair follicles and sebaceous glands. Keratin is present in loose lamellæ.

FIG. 2. Skin section of a rat on a fat-free diet showing marked hyperkeratosis of the hair follicle, dilatation of their funnels by keratotic plugs. The lining epithelium of the hair follicles and sebaceous glands do not show atrophic changes. Keratin is denser than in the case of vitamin A deficiency.

(Figs. 1 and 2—Ehrlich's acid hæmatoxylin and eosin stain, × 65).

essential fatty acid deficiency was characterized by hyperkeratinization wherein the keratinous material was deposited in dense masses. The epithelial lining of the hair follicles and the sebaceous glands were not effected even in extreme cases.

Finally, a third conclusive experiment was carried out by giving a mixture of hydrogenated oil and gingelly oil (a rich source of essential fatty acids), as the source of the fat in the diet. By replacing a part of hydrogenated fat by gingelly oil in the diet, it was shown that lesions are completely prevented. Thus, indirect evidence in support of the fact that the essential fatty acid content of the oil is responsible for maintaining the skin in a healthy condition has been obtained.

It is concluded that deficiencies of vitamin A in conjunction with essential fatty acids play an important role in the production of cutaneous lesions in rats resembling those in 'phrynoderma'. It is suggested that 'phrynoderma' may be due to the combined deficiencies of both these factors. The experimental evidence further points out that lack of vitamin A plays a larger role in the production of cutaneous lesions resembling 'phrynoderma'.

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Bombay, M. V. RADHAKRISHNA RAO.
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CARBOHYDRATES OF GARLIC (*ALLIUM SATIVUM* L.) AND ONION (*A. CEPA* L.)

IN extending our investigations on minor food materials, the aid of paper chromatography was sought for a preliminary screening in determining the choice of a material for nutritional studies. Thus, the qualitative make-up of water-soluble carbohydrates in the bulbs of garlic and onion was determined (Fig. 1). It was found to be similar to what has been already reported by us for *Agave vera cruz*.[1]

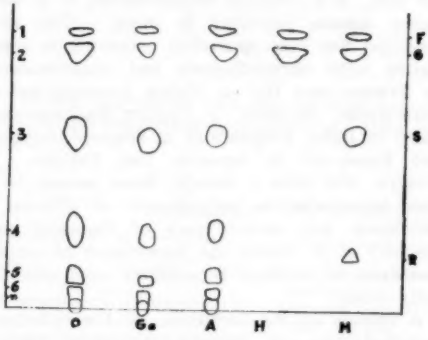

FIG. 1. Chromatogram of the carbohydrates of onion and garlic.

Onion juice (O), Garlic juice (Ga), Agave juice (A; for comparison): hydrolysates of the three (H: all three gave only glucose and fructose): reference sugars (M: mixture of fructose, glucose, sucrose and raffinose, corresponding separated spots, marked F,G,S and R): Developed in butanol-acetic acid-water (4 : 1 : 5) for 6 days (ascending). Sprayed with benzidine-trichloracetic acid reagent. (Guide strips of O, Ga sprayed with phloroglucinol–trichloracetic reagent showed the presence of easily hydrolysable ketose residues in the carbohydrates corresponding to spots 4 to *n*; *cf.* refce. 1).

The presence of fructosan type of carbohydrates in *Allium* is known,[2] but they do not appear to have been precisely characterised. This aspect is being studied. Fructose, glucose and sucrose detected among the sugars, being normal, need no comment, except perhaps in relation to the ultimate polyfructosan synthesis. What deserves emphasis here, is the pattern of carbohydrate make-up, especially those corresponding to spots 4, 5 and 6. The fact that this uniform, though at the moment qualitatively determined pattern recurs with the carbohydrates derived from such widely differing sources as the tubers of Jerusalem artichoke (Compositæ),[3] the stem of *Agave vera cruz* (Amaryllidaceæ)[1] or the bulbs of *Allium* (Liliaceæ), all of which are free from starches—seems to be significant for the understanding of the synthesis of polyfructosans, the status of which as a reserve plant food is now fairly well established.[4]

We wish to thank Dr. Girdhari Lal for his keen interest in the work.

Central Food Tech. Research Institute, Mysore, *April* 24, 1953.

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PAPER CHROMATOGRAPHIC SEPARATION OF B-GROUP VITAMINS

Most of the B-group vitamins have been individually studied by paper chromatographic technique and their separations from their derivatives or similarly related substances were achieved by various workers using different solvents.[1-6] Brown and Marsh[7] separated the vitamins in a mixture of thiamine, riboflavin, nicotinamide and pyridoxine hydrochloride by running a single paper chromatogram and identified the vitamins spectroscopically by means of automatic scanning device. In this laboratory, most of the B-group vitamins, *viz.*, thiamin hydrochloride, riboflavin, choline chloride, inositol, nicotinic acid, nicotinamide, B_{12}, calcium pantothenate, biotin, pyridoxine hydrochloride and *para*-aminobenzoic acid were successfully separated and identified from a mixture containing all these vitamins by ascending paper chromatography. The paper containing the spots of the mixture of vitamins was irrigated with the non-aqueous phase of a mixture of 2 volumes of *n*-butanol, 1 volume each of methyl alcohol, benzene and water. In a period of 4½ hours, the solvent front traversed a distance of about 18 cm. parallel to the filter-paper fibre and a fairly good separation was achieved. All the vitamins were identified by applying in most cases specific chemical tests. However, in the case of biotin, the use of a specific reagent, tetranitromethane was not found suitable because the minimum amount of the vitamin required for identification was 150 μg. Dilute acidified potassium permanganate solution, on the other hand, gave a yellow spot of biotin sulfone[11] even when 4 μg. of

TABLE I

No.	Vitamin	Identification	Colour of the spot	Mean R_f value†	Minimum concentration required for identification (μg.)
1	Inositol	Ammoniacal silver nitrate (4)	Brownish black	0·14	5·0
2	Vitamin B_{12}	Light pink spot	Light pink	0·25	1·5
3	Choline chloride	Iodine vapour (8)	Reddish brown	0·34 & 0·44*	3·0
4	Calcium pantothenate	Ammonium salt of β-napthaquinone-4-sulphonic acid after alkali treatment (9)	Violet	0·36	80·0
5	Riboflavin	Yellow spot andye llowish-green fluorescence in ultra-violet	Yellow	0·40	0·8
6	Nicotinic acid	Exposed to CNBr vapour and sprayed with benzidine in 1 : 1 ethanol-water (10)	Violet	0·44	0·5
7	Nicotinamide	,, ,, ,,	Violet	0·73	2·0
8	Thiamine hydrochloride	Fluorescence of thiochrome in ultra-violet	Blue	0·47	4·0
9	Biotin	Dilute acidified potassium permanganate solution	Yellow	0·64	4·0
		Tetranitromethane	Yellow	0·64	150·0
10	Pyridoxine hydrochloride	Dilute acidified potassium permanganate solution	Yellow	0·73	1·5
11	*Para*-amino benzoic acid	*Para*-dimethylamino benzaldehyde in glacial acetic acid	Yellow	0·80	0·5

* Choline was found to give two spots when thiamine was also present in the mixture.

† Ascending paper chromatography.

biotin was present. Either of these tests may be satisfactorily employed depending on the concentration of the vitamin in the mixture. The average R_f values obtained in about 50 runs under laboratory conditions, the minimum concentration of the vitamin required for identification and the tests applied in brief are given in Table I. This method was successfully employed for identifying the various constituents in commercial vitamin tablets and further extended by employing circular paper chromatography. A detailed account of the work will be published elsewhere.

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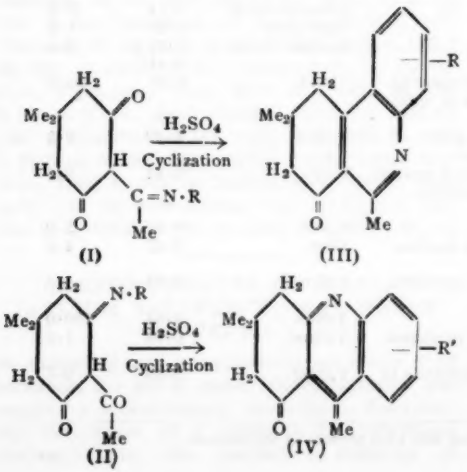
CYCLIZATION OF THE IMINES OF C-ACETYLMETHONE: FORMATION OF PHENANTHRIDINES

THE products of condensation of C-acetylmethone with primary amines[1] can be represented by either of the two formulæ, (I) and (II). Evidence in favour of the formula (I) is presented in this note.



where R = phenyl or substituted phenyl radical, and R' = substituent(s) on the benzene ring.

On cyclization, compounds having structure (I) would lead to the formation of phenanthridine derivatives (III) while compounds of structure (II) would yield acridine derivatives (IV). In the present study, the condensation products (imines) of C-acetylmethone with aniline, *p*-chloro- and *p*-bromo- anilines, *o*- and *m*-toluidines, and *o*- and *p*-xylidines have been cyclized by heating them with concentrated sulphuric acid on a water-bath. The cyclized products have been characterized as phenanthridine derivatives (III). The melting points of these phenanthridines and their derivatives are recorded in the table below.

The cyclized product from aniline (1) was studied in detail as a typical member of the series. It was oxidized with dilute nitric acid, when 2-methyl-quinoline-3, 4-dicarboxylic acid was obtained. The acid was characterized by analysis and comparison with an authentic sample.

No.	Name of the compound	M.P. (uncorrected)
1	7-Oxo-7, 8, 9, 10-tetrahydro-6, 9, 9-trimethyl-phenanthridine	99° –9·5°
	Picrate	219° –20° (dec.)
	Hydrochloride	237° –8°
	2 : 4 Dinitrophenylhydrazone	278° (dec.)
2	2-Chloro-7-oxo-7, 8, 9, 10-tetrahydro-6, 9, 9-trimethyl-phenanthridine	130·5°
	Picrate	221° (dec.)
3	2-Bromo-7-oxo-7, 8, 9, 10-tetrahydro-6, 9, 9-trimethyl-phenanthridine	137° –8°
	Picrate	224° (dec.)
4	7-Oxo 7, 8, 9, 10-tetrahydro 4, 6, 9, 9-tetramethyl-phenanthridine	105° –6°
	Picrate	169·5°–70·5°
	Hydrochloride	162° –3°
	2 : 4-Dinitrophenyl hydrazone	335°
5	7-Oxo-7, 8, 9, 10-tetrahydro-3, 6, 9, 9-tetramethyl-phenanthridine	..
	Picrate	186° –7° (dec.)
	Hydrochloride	250° –1°
6	7-Oxo-3, 4, 6, 9, 9-pentamethyl-7, 8, 9, 10-tetrahydro-phenanthridine	125°
	Picrate	158° –9°
	Hydrochloride	200° –2°
	2 : 4-Dinitrophenyl hydrazone	284° (dec.)
7	7-Oxo-1, 4. 6, 9, 9-pentamethyl-7, 8, 9, 10-tetrahydrophenanthridine	122° –3°
	Picrate	139·5°–40·5°

Full details will be published elsewhere.

Our thanks are due to Dr. Sukh Dev for his kind interest in this work.

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A METHOD FOR THE ISOLATION OF INDIVIDUAL DENDRITIC CELL FROM HUMAN AND GUINEA-PIG SKIN

IN connection with a research project pertaining to the relationship of the chromatophorotropic hormone of the pituitary gland with the pigmentation of the skin,[1-3] it was necessary to devise a technique for the study of the mechanism of pigment formation in the dendritic cells of the basal layer of the skin. These cells are credited with the power of synthesis of melanin pigment. After repeated failures, the following method was evolved which gave fairly satisfactory results in our hands. A preliminary note is published in order to help workers in this field. Detailed description with relevant data pertaining to the mechanism of melanogenesis will be published elsewhere in due course.

Epidermis was separated from dermis according to the method of Medawar.[4] The method of Billingham[5] was then followed to isolate the dendritic cells. It was, however, found that if the method of fixation for half-an-hour in formol-calcium (Baker[6]) as recommended by Billingham is followed, the dendritic processes become so cemented with the matrix that subsequent separation becomes difficult. After many trials, we found that this fixation should be permitted to operate for only two minutes instead of half-an-hour. A modification was further necessary in the Dopa treatment of the epidermis in that a saline solution in phosphate buffers had to be used in place of aqueous solution and the pH had to be controlled and kept at 7·8 for one hour. This quick treatment prevented damage to the dendritic cells. After the Dopa reaction is over, as indicated by sepia tone of the solution, the pure epidermis piece was mounted in a drop of 15 per cent. aqueous glycerine with the dermal side of the epidermis above, and this was gently dabbed with a camel hair brush. The skin specimen was then removed and the glycerine solution left on the slide is covered by a cover glass and sealed by 'Cutex'. The dendritic cells come off from the epidermis and remain on the slide. The glycerine prevents dehydration and permits the cell to remain in a more or less natural free state.

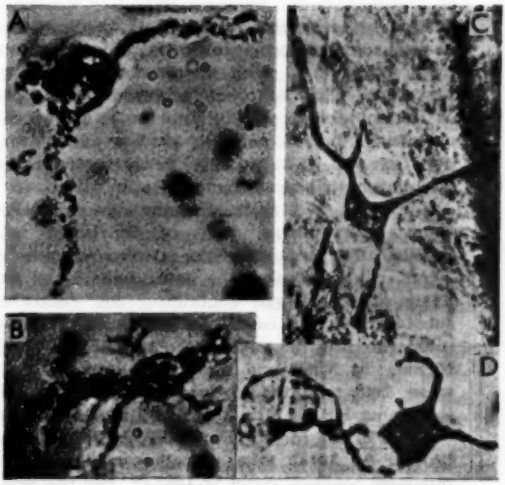

FIG. A & B. Isolated d. c. of human skin (× 530).
FIGS. C & D. Isolated d. c. of guinea-pig skin (×400).

Photomicrographs A and B (see plate) show the isolated d.c. from the peroneal surface of the leg of human beings and photomicrographs C and D refer to the isolated d.c. from the black part of the back and ear of the spotted guinea-pig.

Central Drug Res. Inst., Lucknow, *June* 8, 1953.

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ROLE OF BIOTIN IN THE CONVERSION OF TRYPTOPHANE TO NICOTINIC ACID

THE formation of nicotinic acid from tryptophane, first demonstrated with rats by Krehl, Sarma and Elvehjem[1] was also subsequently shown to take place in the case of other mammals,[2,3,4] the fungus *Neurospora crassa*[5] and plants.[6] Further studies have been carried out by different workers to find out the various factors which affect the conversion of tryptophane to nicotinic acid. It was shown that some of the vitamins of the B group like pyridoxine and riboflavin[7] thiamine and folic acid[8] were found to influence this conversion.

However, the role of biotin in the breakdown of tryptophane to nicotinic acid has not been studied hitherto, and in this note the influence of biotin on the formation of nicotinic acid from tryptophane has been demonstrated for the first time. This has been achieved by the use of antimetabolite of biotin, γ, 3 : 4-ureylene cyclohexyl butyric acid in studies on *Neurospora crassa* (Strain 39401) and germinated greengram (*Phaseolus mungo*).

The basal medium used in the case of *Neurospora crassa* was that of Horowitz and Beadle.[9] The organism was allowed to grow in 50 ml. conical flasks, the total volume of the media being 10 ml. containing the following substances in the basal medium in mg., ammonium tartrate 25; NH_4NO_3 : 10; K_2HPO_4 : 10; $MgSO_4$: 5; NaCl and $CaCl_2$: 0·1 (each); dextrose 200 and the following trace elements in gamma B : 10; Mo : 2·0; Fe : 2·0 and Zn : 20. The pH of the medium was 5·6. After 72 hours' growth at 30° C., the mycelia were carefully removed, washed, dried at 105° C., and the dried mycelia were weighed in a Roller Smith torsion balance. The total nicotinic acid in the media and mycelia was found out according to the method of Shanmuga Sundaram, Ranganathan and Sarma.[6] The results are presented in Table I. From the weight of the mycelia and the total nicotinic acid present, it can be seen that the anti-vitamin of biotin,—γ, 3 : 4-ureylene cyclohexyl butyric acid exerts a deleterious effect which was overcome by the addition of excess biotin.

TABLE I

No.	Substances added to the medium	Total nicotinic acid (mycelium + medium) in gamma	Mat weight in mg.
1	200 γ L tryptophane in 5 ml. basal medium (D.C.)+5 ml. water (control)	6·70	17·2
2	200 γ L tryptophane in 5 ml. basal medium (D.C.)+2·0 mg. ureylene compound in 2·0 ml. water+3·0 ml. water	2·05	5·5
3	200 γ L tryptophane in 5 ml. basal medium (D.C.)+2·0 mg. ureylene compound in 2·0 ml. water+3γ biotin in 3·0 ml. water	8·50	18·4
4	200 γ L tryptophane in 5 ml. basal medium (D.C.)+3·0 mg. ureylene compound in 3 ml. water+2 ml. water	1·90	4·0
5	200 γ L tryptophane in 5 ml. basal medium (D.C.)+3·0 mg. ureylene compound in 3·0 ml. water+5 γ biotin in 2 ml. water	8·60	16·8

D.C.—Double concentration.

A similar observation of the inhibition in the synthesis of nicotinic acid by γ, 3 : 4-ureylene cyclohexyl butyric acid is noticed in the case of germinating greengram. The results are presented in Table II. Though the inhibitory effect of the antimetabolite was not as striking as that with *Neurospora crassa*, the decrease in nicotinic acid content is significant and the reversal by biotin indicates the importance of this vitamin in the conversion of tryptophane to nicotinic acid. The germination of the seeds and the estimation of nicotinic acid were done according to the method of Shanmuga Sundaram, *et al.*[6]

TABLE II

Nicotinic acid expressed in γ/g.
Nicotinic acid in dry seed 14·0 γ/g.

Dish No.	Substances used in the medium	Hours of germination	
		48 hrs.	72 hrs.
1	25·0 ml. water (control) ..	28·8	33·5
2	24·0 ml. water+1 mg. ureylene compound in 1·0 ml. water	22·9	27·7
3	23·0 ml. water+1 mg. ureylene compound in 1·0 ml. water+1 γ biotin in 1·0 ml. water	26·5	31·8

Further work on the utilisation of other metabolites of tryptophane in presence of γ, 3 : 4-ureylene cyclohexyl butyric acid by *Neurospora crassa* (39401), and the site of action of biotin in the conversion of tryptophane to nicotinic acid is in progress and will be published elsewhere.

Our thasks are due to Dr. H. K. Mitchell, of California Institute of Technology, for the generous gift of *Neurospora* mutants and Dr. Richard O. Roblin (Jr.), of the American Cyanamid Co. (U.S.A.), for γ, 3 : 4-ureylene cyclohexyl butyric acid used in this investigation.

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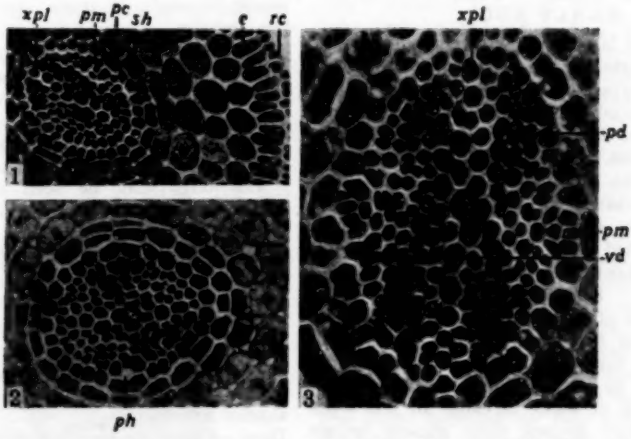
VASCULAR DIFFERENTIATION IN THE RADICLE OF MUSTARD

THE present anatomical study of the radicle of mustard (*Brassica campestris* L.) deals with the various tissues that make up this organ, with special reference to the differentiation of the first phloem and xylem elements. Materials used were: (1) seeds soaked for 6 hours in water; (2) seedlings with radicles just emerging out; and (3) seedlings with radicles approximately 2 mm. in length. The technique followed was described in a previous communication.[1]

Fig. 1 represents a transverse section of the radicle tip of material,[1] showing a single-layered deeply stained epidermal cells (*e*) surrounded by a layer of root-cap (*rc*) cells and the cortex composed of several rows of cells of which the ones nearer the epidermis are less tangentially elongated. In the centre lies the meristematic stele surrounded by a well differentiated starch sheath (*sh*) and the pericycle (pc). A median row of cells stretching from one inner side of the pericycle to the other (*xpl*) is conspicuous by their size and deeper staining properties. These are the mother-cells of the future diarch xylem plate, vacuolation of the protoplasm of which begins in the middle (Fig. 3, *va*). Esau[2,3] working with carrot and sugar beet has made similar observations. The groups of parenchyma on either side of the protoxylem pole (Fig. 3, *pa*) vacuolates more rapidly (than the cells of the xylem plate) and these, along with the vacuolated central cells (*va*) of the xylem plate, give a characteristic pattern to the stele (Fig. 3).

The mother-cells of the future phloem elements are placed opposite to each other in a plane at right angles to the xylem plate. Diameters of these cells is slightly smaller than those of the surrounding ones (Fig. 1, *pm*) and at higher levels they are slightly deeper stained than some of their immediate neighbours (Fig. 3, *pm*).

First vascular elements to mature (Material No. 2) belong to the phloem region and these have all the characteristics common to the protophloem sievetubes of angiosperms.[4] They are not accompanied with companion cells and thus resemble the root of pear.[5] Another resemblance between these two roots lies in the fact that the protophloem elements on either side of the xylem plate mature at different heights (Fig. 2). Up in the same radicle are found the first two proto xylem elements maturing again at different levels. One cell on either extremity of the xylem plate abutting the



FIGS. 1—3. Transverse sections of mustard radicles. *e*, epidermis; *pa*, parenchyma; *pc*, pericycle; *ph*, differentiated phloem element; *pm*, phloem mother cell; *rc*, root cap; *sh*, starch sheath; *va*, vacuolated cells of the xylem plate; *xpl*, xylem plate.

FIG. 1. Radicle of a seed soaked for 6 hours sectioned at the distance of 263 μ from the tip, × 107.

FIG. 2. Radicle of a seed that has just split, × 109.

FIG. 3. Radicle of a seed soaked for 6 hours passing near the lower hypocotyl zone, × 223.

pericycle shows contracted cytoplasm and deposition of secondary walls in the form of spiral thickenings.

In spite of the fact that the differentiation of the phloem elements starts earlier than those of the xylem ones, mature elements are added more rapidly at the protoxylem poles than at the protophloem ones as would be evidenced from the fact that in several No. 3 materials the second phloem element of a pole did not mature till there were 3-4 differentiated xylem elements near the first-formed ones.

Dept. of Botany, S. C. CHAKRAVARTI.
Balwant Rajput College,
Agra, India,
October 3, 1952.

1. Chakravarti, S. C., *Nature*, 1953, **171**, 223. 2. Esau, K., *Hilgardia*, 1940, **13**, 175. 3. —, *Ibid.*, 1943, **9**, 397. —, 4. *Bot. Rev.*, 1943, **9**, 125. 5. —, *Hilgardia*, 1943, **15**, 299.

LIFE-HISTORY OF *PHENACOCCUS INSOLITUS*, GREEN (THE BRINJAL MEALY BUG)

THIS bug which is covered with coarse granular white waxy material, is observed congregating on the undersurface of the brinjal leaves. It is the ratoon brinjal crop and isolated remnants of the previous brinjal crop that are usually severely attacked by this bug, but even a fresh crop may not be immune from its attack. The bugs suck the sap from the shoots and leaves and the plants assume a sickly appearance. Leaves are shed after becoming yellow and mouldy and shoots get shrivelled up.

LIFE-HISTORY

Mating starts after a few minutes of the last moult and lasts for 4-5 minutes. A male can fertilize 15-20 females. After a fortnight, the females begin to excrete a loose sticky white sac in the form of waxy threads. In this loose cottony sac, they deposit their minute brown eggs. One female bug lays 2-3 such egg-sacs and each sac may consist of 100-120 eggs. Females shrink in size after egg-laying and die 3-4 days thereafter. Eggs hatch out to small greyish nymphs which very soon spread over the leaf and arrange themselves besides the veins. After 3-4 days the bugs begin to secrete through their derm pores the white mealy covering all over their body. The nymphs undergo 4 moults before they reach the adult stage.

First moult occurs after 10-15 days of emergence. All the white mealy powder is thrown off. Bugs attain straw colour. They move about very swiftly from top to bottom of the plant and generally become attached to a fresh leaf. After fixing themselves they insert their beaks in the leaf-tissue to suck the sap and begin to secrete the white covering matter. No differentiation can be made between the male and female at this stage.

Second moulting occurs after 7-10 days. The bugs are now of straw colour. They enlarge in size and cast off all the white coverings. They ascend and descend the plant several times and migration starts in all directions. They go on dispersing from leaf to leaf and from one plant to another, but ultimately the nymphs settle down and begin to secrete the white covering material. From now onward the bugs are constantly visited by small red ants for the honey dew they secrete.

Third moulting takes place after one week. At this stage the males and females can be distinguished. The male insect migrates to a secluded place, generally in the leaf-whorls of developing shoots or underside leaves and forms a small white cocoon in which it spends the pupal period of 9-10 days. The body of the would-be male is more slender than that of the female.

Females undergo fourth moult after 8-10 days of the third moult and become adult. Near about this period the winged males also come out of the cocoon and fertilize the females. The males cause no damage to plants. Number of males is less than the females.

The bugs may be seen at every stage of development on brinjal leaves from March to October. The nymphs and adults exhibit an arrested development from November onwards and may be found in all stages among fallen leaves, in trash and in the cracks and crevices of the soil. Their activities are resumed by the end of February.

The work is being carried on under the supervision of Dr. U. S. Sharga, to whom the author's thanks are due.

Dept. of Zoology-Entomology, N. S. AGRAWAL.
Govt. Agric. College,
Kanpur, *January* 12, 1953.

SCLEROTIAL ROOT-ROT DISEASE OF GROUNDNUT IN UTTAR PRADESH

DURING the year 1948, groundnut (*Arachis hypogaea* L.) was found severely affected with a root-rot disease caused by *Sclerotium rolfsii* Sacc. at Government Agricultural College and Research Farms, Kanpur. The disease appears every year, but in some years, it becomes serious and causes damage to the crop upto

27 per cent. or more. The occurrence of the disease in India was reported by Butler and Bisby[1] in 1931 from Bombay and Bengal States. The disease is also known to occur in Madhya Pradesh. This is the first report of the disease from the Uttar Pradesh. As the disease is an important one, attempts were made to test the resistance of varieties and strains of groundnut against the attack of *S. rolfsii*.

The disease affects the yield of the crop as the affected plants produce only few shrivelled nuts, majority of them are useless for seed purpose. A loss of about 23 per cent. and 38 per cent. in number of pods and their weight was calculated from diseased plants.

During the years 1948, 1949, 1950 and 1952, the average infection of the disease recorded at Kanpur was 14, 12, 15 and 9 per cent. respectively while during 1947 and 1951, the average disease infection was 3 and 5 per cent. respectively. The disease spreads rapidly during the months of August and September. The well distributed rainfall during these months appears to favour the disease.

Field observations made during 1947 to 1950 revealed that out of a collection of 61 cultures of groundnut at Research Farm, Kanpur, 15 cultures were free from infection. During 1950, 1951 and 1952, pot and field experiments were set up to test the resistance of these cultures of groundnut against *S. rolfsii*. To give varied conditions of soil moisture and temperature, the crops were sown on two different dates at an interval of 20 days. The soil was heavily inoculated with the mycelium and sclerotia of the fungus at the time of sowing and also after one month of growth of the plants. Three susceptible varieties, *viz.*, R3, R7 and T218 were sown as checks.

FIG. 1. Showing affected plant with mycelium of *Sclerotium rolfsii* on shoots and root at ground-level (Variety: R3).

In 1951 and 1952, out of the 15 varieties which were found to be resistant in 1950(2), 12 were selected for testing their resistance to the disease. Ten varieties, *viz.*, T6-2, 11-11, 14, 16-4, 17, 19, 22, 24, 25 and 4201 maintained their resistance in pot and field experiments. Two varieties, *viz.*, T 1 and T 15 were found to be slightly susceptible (below 2 per cent. infection). The varieties for checks, *viz.*, R3, R7 and T218 showed 27·0, 10·0 and 9·0 per cent. infection respectively.

The writers are grateful to Dr. T. R. Mehta, for providing cultures of groundnut used during the studies.

Lab. of the Plant Pathologist to Government, U.P., Kanpur, *December* 23, 1952.

BABU SINGH.
S. C. MATHUR.

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POWDERY MILDEW, *LEVEILLULA TAURICA* (LEV.) ARN., ON A NEW HOST, *SOLANUM TORVUM* SWARTZ.

THE leaves of *Solanum torvum* Swartz.* have recently been found in Bangalore to be heavily infected by the powdery mildew, *Leveillula taurica* (Lev.) Arn. Whitish, powdery, nearly circular spots are seen on the lower surfaces. Pale yellow or pale green areas are noticed on the corresponding upper surfaces, particularly when the leaves are held up against the light. The spots increase in size gradually, become irregular and coalesce with one another. In advanced stages of infection the whole of the under-surface is covered with a powdery mass, and such leaves soon drop down.

The mycelium of the fungus is endophytic, septate, intercellular, sending knobbed haustoria inside the cells. A number of thin-walled, septate and usually branched conidiophores arise through the stomata, each terminating in a conidium. The conidia are unicellular, hyaline, smooth-walled and elliptic, barrel-shaped or club-shaped. They germinate in water producing a germ tube usually from the broader end. The nature of the conidiophores and the size

and shape of the conidia agree with those of *Leveillula taurica*. The perithecial stage has not been noticed.

This is the first record of the fungus on *Solanum torvum*.

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M. H. DELVI.

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Dept. of Agriculture in Mysore,
Bangalore,
March 22, 1953.

• The writers wish to acknowledge with thanks the help of Sri. M. Ananthaswamy Rao, Lecturer in Botany, Central College, Bangalore, in identifying the host plant.

ON THE OCCURRENCE OF *PHOMA CHRYSANTHEMICOLA* HOLLOS ON *CHRYSANTHEMUM* SP.

SEVERAL varieties of chrysanthemum seedlings, recently imported from Holland for a local garden, were examined in this laboratory before release. Some of them showing necrosis of the upper parts of the stems and slight root rot, were grown under quarantine conditions at the laboratory.

Some of these seedlings did not survive and an infection with a pycnidial fungus was noticed on the dead-stalks of a few of them after about 4 to 5 weeks. These were carefully removed and preserved in formalin for further examination, while the pots and soil were also properly disinfected. On examination, the fungus was found to be a *Phoma* sp., apparently not so far reported from India. The pycnidia were scattered on the stem, separate, but sometimes gregarious. They were brown, mostly sub-globose, superficial or erumpent, membranous or sub-carbonous, and measured 138-207 μ to 110-138 μ. The spores were hyaline, continuous, usually oblong or slightly elliptical, bi-guttulate, and measured 5-6 $\times$ 1·75-2 μ.

Three species of *Phoma*, *P. chrysanthemicola* Hollos, *P. chrysanthemi* Vogl., and *P. herbarum* West have been reported on *Chrysanthemum* spp., the first from Hungary[1] and others from Italy.[2,3] An undetermined species, considered to be a pycnidial form of *Ramularia bellunensis* Speg., is also recorded from Italy.[4] The *Phoma* described in this paper closely resembles *P. chrysanthemicola* Hollos in morphological characters, and is, therefore, referred to the same species.

This fungus does not appear to have been recorded from Holland, but it is apparent that it was carried in the seedlings imported from that country.

The author is grateful to Dr. P. R. Mehta for advice and encouragement.

Directorate of Plant Protection,
Quarantine and Storage,
Plant Quarantine Station,
Poona,
March 25, 1953.
S. N. S. SRIVASTAVA.

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BACTERIAL SHOT-HOLE AND FRUIT CANKER OF *AEGLE MARMELOS* CORREA

IN August 1952, a bacterial shot-hole and fruit canker on *A. marmelos* was noticed in the Agricultural College Farm, Poona. The symptoms on the leaf are characterised by round, water-soaked spots (0·5 mm.) surrounded by a clear halo (Fig. 1, A). Gradually the spots

A B C

FIG. 1

increase in size (3 mm. to 5 mm.) and form brown lesions with saucer-like depressions in the centre surrounded by oily, raised margin. Many times, the few spots coalesce and the infected portion becomes chlorotic. Bacterial ooze in the form of shining beads and scales is found on both sides of spots. The primary localised lesions all over the leaf are always followed by falling out of the dead tissues leaving circular or slightly irregular perforations or "shot-holes" (Fig. 1, A). Very often, the dead portion of the lesion remains attached, though separated from the surrounding healthy tissue (Fig. 1, B).

On the fruits, the pathogen produces round, raised, water-soaked spots measuring 4 mm. to 7 mm. with no halo. After sometime, the crater-like depressions are noticeable in the centre of spots surrounded by irregular, oily, raised margins. The lesions then become very

corky, irregular in shape and chocolate brown (Fig. 1, C). The pathogen infects twigs and thorns also. On the former, large lesions (150 × 4 mm.) are commonly formed. The infected tissue ruptures in the centre giving a rough, corky appearance. Bacterial gummy exudation is commonly found on all infected parts.

Morphological and Physiological Characters of the Bacterium.—Short rod, single or in chains of two, gram negative, capsulated, motile by a single polar flagellum, measures 1·5 × 0·9 μ. On potato dextrose agar plates, colonies smooth, convex, glistening with entire margins, consistency butyrous, 9 mm. after 4 days, naphthalene yellow; on nutrient agar plates, colonies smooth, circular with lobate margins, consistency not butyrous, ivory yellow, 9 mm. after 6 days; starch and casein hydrolysed; gelatin liquefied; acid but no gas from dextrose lactose, and xylose but not from salicin; ammonia and hydrogen sulphide produced; litmus reduced; nitrates not reduced; optimum temperature for growth 25°-27° C., thermal death-point about 52° C., sodium chloride tolerant up to 2 per cent.

Pathogenic on *Aegle marmelos* Correa, *Citrus aurantifolia* Sw. and *Feronia elephantum* Correa. It, however, does not produce leaf canker on *C. aurantifolia*, a characteristic symptom produced by *Xanthomonas citri* (Hasse) Dowson which fails to infect *A. marmelos* and thus the present findings are in conformity with those of Lee.[1] It is proposed to name the pathogen *Xanthomonas bilvæ* nov. sp. after "*bilva*", the Sanskrit name of *A. marmelos*.

Fuller details will be published elsewhere.

Plant Pathol. Lab., M. K. Patel.
College of Agric., S. B. Allayyanavaramath.
Poona, Y. S. Kulkarni.
March 26, 1953.

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CHROMOSOME NUMBERS OF CERTAIN SPECIES OF *ERIANTHUS*, MICHX.

Chromosome numbers have been recorded[1] for certain forms of *Erianthus Ravennæ*, *E. munja* and *E. arundinaceus*. The numbers ranging as they do in the series $2n = 20$, 30, 40 and 60 indicate polyploidy in the genus. *E. Ravennæ* has $2n = 20$, while the higher numbers occur in both the species *munja* and *arundinaceus*. In the *Chromosome Atlas*[2] record has been made of the chromosome numbers of *E. elegans* ($2n = 40$), *E. sara* (bengalense) ($2n = 60$) and *E. arundinaceus* ($2n = 40$ and 60). In *E. maximus* Brongn., native to New Calendonia and Fiji Islands, all multiples of 10, from $2n = 60$ to $2n = 100$ have been recorded.[3]

Chromosome counts have now been determined for four more species of the genus, *viz.*, *E. fulvus*, *E. elephantinus*, *E. Hookeri* and *E. longisetosus*, live specimens of which have been collected from various parts of India in the course of the work of the Spontaneum Expedition Scheme. In the case of *E. fulvus*, the counts are from root-tips, while in the others, the counts are from clear meiotic plates of pollen mother cells, observed in iron-aceto-carmine smears. Forms of the same species collected from different areas (Assam, Nepal, Kumaon, etc.) possess the same number.

Species	No. of forms examined	Locality of collection	Chromosome number observed
E. fulvus, Nees ex Steud.	2	Kangra Hills and Nepal	$2n = 20$
E. elephantinus, Hook.	2	Kumaon and Lower Assam Valley	$n = 10$
E. Hookeri, Hack.	2	Assam and Tirap Frontier, NEFA	$n = 15$
E. longisetosus, Anderss. ex. Benth.	2	Lower Assam Valley and Naga Hills	$n = 15$

This is presumably the first record of the chromosome numbers of these species. The numbers confirm the occurrence of polyploidy in the genus. Within the range of the species so far examined, the lowest number $2n = 20$ is found in *E. Ravennæ*, *E. elephantinus* and *E. fulvus*. The three 20-chromosome species differ from each other to a much greater extent than the two 30-chromosome species do, in respect of both vegetative and floral characters. The differences between *E. Hookeri* and *E. longisetosus* are much less conspicuous and more minute than the differences between *E. Ravennæ*, *E. fulvus* and *E. elephantinus*. Within the range of species studied by us, there does not appear to be either a close positive or negative relationship between the size of the plant and the chromosome number. Further investigations are in progress.

Sugarcane Breeding Inst., J. T. Rao.
Coimbatore, *April* 15, 1953. C. N. Babu.

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REVIEWS

Crime Investigation—Physical Evidence and the Police Laboratory. By Paul L. Kirk, Ph.D. (Interscience Publishers Inc., New York).

With the advancement of science, its applications to crime detection have also increased a great deal, and though there are not many well-equipped forensic science laboratories in our country, the investigating officer is beginning to recognise the value of scientific aids and is summoning expert assistance more and more to aid him in the detection of crime. This valuable book, although written with American conditions in view, will greatly help police scientists and investigators to have an idea of the various ways in which modern science can aid in crime detection. As the author has stated in the preface, it is necessary for the investigating officers not only to know how to collect and preserve physical evidence but also to understand what to collect and *why* it should be collected. All this information is made available to him in this book.

The first section deals with many interesting and useful subjects, such as organisation of the police laboratory museum, equipment for investigation, clothing, fibres, blood and other physiological fluids, glass, soil, paint, metals, vegetable materials, casts, tracks and traces, tool marks, fire arms, fires, explosions, finger prints, poisons, documents and photography, besides a very useful chapter on the expert witness. The second section deals with the design and organisation of the laboratory, procedures for determining physical properties, such as density, refractive index, etc., tests for common chemical constituents, spectrography, absorptiometry and laboratory examination of hairs and fibres, stains, blood and other physiological fluids, broken glass, soils, paints, fire arms, tool marks, evidence from fires, explosives, finger prints, poisons and documents.

While dealing with the tests for blood, the author mentions chemical luminescence as a test of great value, that it is comparatively though not completely specific and that it does not interfere with subsequent tests of the same or other types. It may be mentioned here that some work has been done on this test in Madras (Naidu and Pitchandi, *J. Proc. Inst. Chem.*, 1943, 16, 94; *Analyst*, 1944, 69, 98) and besides finding that some vegetable juices such as of the prickly pear gave positive results to this test, it was also shown that blood stains on rusty implements, earth and vegetable tissues disintegrated after treatment and hence only a portion of the stain and not the whole stain should be used for this test.

The matter in this book has been presented in a simple form and it will be interesting to non-technical readers also. Every police officer interested in modern scientific criminal investigation will profit greatly by going through this book. The second section of the book, in particular, will also be of great help to workers in forensic science laboratories.

N. PITCHANDI.

Applied Electricity. By H. Cotton. (Cleaver-Hume Press Ltd., London), Second Edition, 1953. Pp. xii + 482. Price 18 *sh.* 6 *d.*

Dr. H. Cotton is well known to students of electrical engineering through his excellent text-books; and this new book is a welcome addition to the series. The author claims in the preface that the book has a two-fold object: first, to provide a sound and comprehensive guide to the fundamental principles of applied electricity, and secondly, to cover the requirements of the syllabus in the subject of Part I of the London B.Sc. (Eng.) Degree. The syllabus for applied electricity differs from that for the old subject—electrical technology—mainly in regard to the amount of fundamental knowledge of magnetism, electrostatics and electromagnetism required. There is no doubt that the author has succeeded in his task admirably. The book is complete so far as the particular subject is concerned and there is no need for the student to refer to other works. In fact, the scope of the book is such that it covers a little more than the minimum examination requirements, and can well be used for general reference. The large number of worked examples and answers to the comprehensive collection of examples at the end of the book should be of considerable assistance to the examination student.

The volume under review, which is the second edition of the book first published in 1951, has been slightly enlarged and includes sections on the M.K.S. system of units, the triode valve and the photocell and a chapter on circle diagrams.

The book is printed on good quality paper and the general format is attractive and the price is reasonable. It can be strongly recommended to all students of electrical engineering.

H. N. RAMACHANDRA RAO.

Power Cables: Their Design and Installation, Vol. 14. (*Monographs on Electrical Engineering.*) By C. C. Barnes. (Chapman & Hall, Ltd.), 1953. Pp. 272. Price 35 *sh.*

The basic design and engineering data used by cable engineers when dealing with enquiries and orders for power cables, have been ably reviewed in the monograph under notice.

In regard to cable identification and assembly of multi-core cables, the author discusses in some detail the present position of aluminium as sheath material in place of lead. Though aluminium sheath is generally found to be superior to lead alloy, the author has rightly pointed out that long-term experience in the behaviour of aluminium in contact with soils is still to be obtained. In discussing the mechanical protection of the lead cable, the author has also touched upon the use of non-magnetic armouring for a single-core cables. A chapter is devoted to the testing requirements of power cables. Calculation of cable dimensions and weights are dealt with in detail and necessary data are given for computing the weight of the component parts of the cable.

Two chapters deal with the subject of permissible current and intermittent ratings of cables including short circuit ratings. The review of the many factors involved in determining the permissible current rating of power cables is particularly useful in view of the present position regarding heavy loadings on cable networks. The effects of thermal resistance, of bedding and serving, and also of the soil on the current rating of cables have also been discussed.

Two chapters are devoted to the discussion of the present state of development of super-voltage cables in England and abroad. It has, however, been rightly pointed out by the author that the information is only an outline; the various theoretical and practical problems associated with super-voltage cables are still far from having been finalized.

Three chapters are devoted to the various aspects of power cable installation such as depth of laying, bonding and earthing, effect of grouping of cables, and jointing and terminating of power cables including gas pressure systems. Modern submarine cables and their installation are considered in a separate chapter. A short reference has been made to the subject of D.C. transmission and the various factors involved. The problems of cable faults and their localization and the care and maintenance of cables including tests on site are treated in two chapters.

In addition to various cable data provided in the different chapters, a large amount of additional data and information on cable characteristics, terms used in cables technology, reference to B.S. specifications, impulse testing of cables, etc., are provided in the Appendix. An up-to-date bibliography makes the book useful as a reference book.

The volume is bound to be very useful to electrical engineers and students interested in the practical or theoretical aspects of the design, manufacture or installation of paper insulated power cables.

C. S. GHOSH.

Advances in Geophysics, Vol. I. By H. E. Landsberg. (The Academic Press, Inc., New York), Pp. xi + 362. Price $ 7.80.

This book gives a summary of the latest advances in the several branches of geophysics. Bellamy gives an account of the automatic processing of geophysical data. The shortcomings of automatic equipment are their inability to produce output records, capable of convenient and efficient mental assimilation and interpretation. He is in favour of unitary digital notations for all records of observational data with some exceptions. Arnold Court discusses some new statistical techniques in geophysics. A combination of classical probability theory and the very recent theory of extreme value permits actual analysis and evaluation of the extremes of many geophysical elements. The theory of extreme values provides a reasonably accurate method of estimating the expected extremes for any given period, say, the highest temperature, strongest wind, severest earthquake, greatest magnetic disturbance or worst flood.

Bert Bolin gives a study of the general circulation of the atmosphere. Non-uniform heating of the earth and the atmosphere is the ultimate cause of motion. A meridional circulation cell is the predominant mechanism for momentum exchange in the tropics. The theory of general circulation is based on the turbulent motion produced by the thermal contrast between equator and the poles. The influence of the non-uniformity of the surface of the earth is the cause of monsoons. Whipple gives the method of exploring upper atmosphere by

meteoric techniques. He describes the visual, photographic and radio methods. By the drag equation, equation for the loss of mass, and equation for luminous intensity, the density of the atmosphere is calculated. The conclusion is that a constant stratospheric temperature to great altitudes is inadmissible. Gerson states the unsolved problems in physics of the atmosphere. The chief of these are, (1) the origin of sporadic E, (2) the stratification of ionic layers—like D and E, and F_1 and F_2, (3) the response of solar activity to SID and magnetic storms, and (4) formation of the aurora and the origin of the geomagnetic field.

Pritchard discusses estuarine hydrography. He gives the theory of Stommel and Cameron on the dynamics of an estuary, the flushing of an estuary, the tidal prism concept, salt balance, and the length of flushing on Ketchum's theory. Woodlard discusses the earth's gravitational field and its exploitation. He explains the application of Bouger gravity anomalies to geologic structure, and the support given by it to isostasy. Balsley describes aeromagnetic surveying, the instruments, their use and typical surveys made.

The book is an excellent summary, by experts, of the latest advances in geophysics, and is an invaluable asset to both students of geophysics and to seekers after knowledge.

P. R. J.

Radiations and Living Cells. By F. G. Spear. (Chapman & Hall, Ltd.), 1953. Pp. xii + 222. Price 18 *sh.* net.

The exact mechanism of action of penetrating radiations on living cells is still not perfectly understood and a great deal of more experimental work has to be done to throw more light on this important problem. The volume under review, which deals succinctly with the action of ionising and penetrating radiations on the living tissues, normal and pathological, is therefore most welcome.

The author's long experience in teaching postgraduate students of radiology and his lucid presentation render this difficult subject of radiation biology easy to read and digest. The effect of ionising radiation, particularly on important tissues such as blood, skin and reproductive organs, has been dealt with in great detail. The chapters dealing with the effect of radiation on other living tissues are also equally instructive. The task of compiling the widely scattered literature on the subject, and presenting it in the form of a handy book like this, has been accomplished with great distinction. This book can legitimately be accepted as a text-book on radiation biology for postgraduate students preparing for diploma course in radiology. To research students in radiation biology and to all who are engaged in the practice of radiation as a method of diagnosis and treatment, this book will serve as a very useful guide. This book will be a useful addition to any library.

YUSUF SIDIQ.

Progress in Nuclear Physics, Vol. 2 (Published by Pergoman Press Ltd., London), 1953. Pp. viii + 294. Price £ 3 3 *sh.*

Volume II of the *Progress in Nuclear Physics* is the continuation of a programme of reviewing some of the important problems of modern nuclear physics by those working on these particular problems. The purpose of these reviews as explained by the editor, Prof. O. R. Frisch, is to supply information and references to persons either not directly working on these problems or to those seeking an introduction to it. In this object the volume has succeeded to a great extent. The lack of space and immensity of some of these subjects naturally make some of the articles a review of references.

The subjects dealt with in this volume are: (*a*) The electron optical properties of magnetic β-ray spectrometers (Vester) in which the theory and construction of different possible designs of β-ray spectrometers are reviewed; (*b*) Nuclear paramagnetic resonance (Pound) deals with the experimental details and theory of the more recent methods of measuring nuclear spins; (*c*) Luminescent materials for scintillation counters (Garlick) is a survey of the properties of crystals and liquids for use with photomultipliers as scintillation counters. The fundamental mechanism of light emission in phosphors is also briefly discussed; (*d*) The neutron-proton interaction (Squires) is an introduction to the theoretical work on the neutron-proton interaction using the effective range theory. A comparison with experimental results is also discussed; (*e*) Nuclear fission (Whitehouse) is a collection of facts of all that is known about the fission of nuclei including a brief discussion of the liquid drop theory and the asymmetry of fragments; (*f*) The lowlying excited states of light nuclei (Burcham). This section is divided into three parts, the first of which deals very briefly with the attempts to theoretically describe the energy levels of light nuclei on various nuclear models. The second describes the experimental methods of determining these energy levels by the methods of scattering and nuclear disintegration, and the interpretation of

experimental data. The third is an analysis of the level schemes of mirror nuclei and isobars; (g) The nuclear shell model (Flowers): The idea of a shell structure in nuclei is an important recent development in nuclear theory. This section deals with the reason why it has been necessary to postulate it and describes its successes in explaining many experimental facts; (h) Ionisation by fast particles (Cranshaw). The study of ionisation by fast particles is a very important one in the determination of energies of particles encountered in cosmic radiation. A brief theoretical description of the process and its experimental applications are described here. R. RAMANNA.

Elements of Nuclear Reactor Theory. By Samuel Glasstone and M. C. Edlund. (MacMillan & Co.), 1953. Pp. 416. Price 35 *sh.*

Nuclear reactor theory is of considerable interest to two classes of readers: those interested in its extreme practical importance for the development of atomic energy, i.e., nuclear power, and those primarily interested in the theoretical problems of neutron diffusion which have resulted in the development of new and advanced mathematical techniques for the solution of integral equations. To both these classes of readers, the book serves as a valuable introduction.

Most of the literature on this subject, especially relating to its practical application, is still on the 'secret' list due to security regulations. But even such information as is available, can be found only in the original papers in various scientific periodicals and documents not easily accessible in many libraries. The previous books on the subject were monographs either on an elementary level or dealing only with a few of the problems. Probably this work is the most coherent "text-book" on the subject now available to young researchers who wish to have a thorough knowledge of the fundamentals of nuclear reactor theory.

The authors have attempted to satisfy readers with varying backgrounds of scientific knowledge. Hence the book opens with elementary chapters on nuclear structure and stability and nuclear reactions which should serve as an introduction to those totally unacquainted with nuclear physics. In trying to meet the needs of such readers, the authors perhaps explain too much or tend to be repetitive in some of the descriptions of nuclear processes. But the subsequent chapters on the production and reaction of neutrons and neutron diffusion should satisfy anyone who wishes to be initiated into nuclear research.

The chapters most interesting to the theoretical physicist are those on the diffusion and slowing of neutrons in homogeneous and heterogeneous reactors and the final chapters on transport theory, all of which serve as valuable preliminary study for a proper understanding of advanced papers on the subject, for example, the classic article of Marshak in *Reviews of Modern Physics* or the recent work of Chandrasekhar and Kourganoff on transfer problems.

To students in Indian and probably Western European Universities, where even declassified atomic energy reports and memoirs are not easily available, this book written by an author of such established reputation like Samuel Glasstone in collaboration with Dr. Edlund, is probably the only satisfactory "source book" on reactor theory. It is particularly valuable to students of physics in India most of whom have no opportunity to have any acquaintance with the problems of nuclear physics.

A. RAMAKRISHNAN.

Vacuum Technique. By A. L. Reimann. (Chapman & Hall, London), 1952. Pp. ix + 449. Price 50 *sh.*

High vacuum techniques have found wide application in some form or other in various branches of science and technology. In fact, the time is probably ripe for the introduction of a regular course in high vacuum engineering in some of our Universities. If such a course is instituted, Dr. Reimann's book will form an ideal text-book for study, since it covers not only the technical aspects of the subject, but also goes into the physics and chemistry of the various processes. The book could also be consulted with profit by research workers in various branches of physics, as it contains a wide range of information, not readily found in such a collected form.

Two chapters deal with backing pumps in general and a discussion of their performance. Molecular and diffusion pumps for high vacua are described in the next three chapters which contain many useful practical hints. A long chapter of 50 pages contains a discussion of pump systems and pumping procedures in general, and in particular with methods of leak detection, construction of demountable and flexible joints, introduction of pure gases into a vacuum system and so on. Glass blowing techniques and the details of making various glass to metal seals occupy more than 100 pages. Methods available for cleaning up the residual gases in a sealed system are considered in a separate chapter and the book closes

with a discussion of various types of vacuum gauges.

Each chapter contains a bibliography listing a number of references to original literature and there is a good index at the end of the book. Altogether a comprehensive volume, the book should be considered moderately priced for the valuable amount of information contained in it. It must find a place in the library of every scientific and technical laboratory.

G. N. RAMACHANDRAN.

Radio Research Special Report No. 25 (*Selected Problems in the Preparation, Properties and Application of Materials for Radio Purposes*). (Published by H.M.S.O., London). Price 1 *sh.* 6 *d.*

An important factor in the progress of radio communications has been the development of new materials and their use in new devices of improved performance. The principal classes of radio materials are conductors, semi-conductors, dielectrics and magnetic materials. Knowledge of the properties and behaviour of conductors is well advanced and suitable materials in this class are available for almost every required service. The properties of the other three classes of materials are not so well understood and a great deal of work remains to be done before their behaviour in all conditions can be completely predicted.

This pamphlet is based on the work of several groups of experts who have studied the present state of knowledge of ceramics, organic pilymeric dielectrics, magnetic materials and semi-conductors. The report is divided into sections dealing with these materials, each section outlining existing knowledge and stating the research problems which most urgently need attention if the material is to be fully exploited for radio purposes.

General Properties of Matter. By C. J. Smith. (Edward Arnold & Sons), 1952. Pp. 580. Price 50 *sh.*

With the enormous developments that have taken place in *Modern Physics* during the last 30 years and the large number of text-books that have appeared in this field, there has been noticed a tendency in recent years to lay emphasis on the newer trends of physics and to neglect subjects like 'Properties of Matter'. In fact, very few good books have appeared on this subject since the publication of the classical text-book by Poynting and Thompson. We, therefore, welcome this eminently readable book by C. J. Smith, whose *Intermediate Physics* must be familiar to most of our readers.

The book under review is the first of a series to be published under the title *A General Degree Physics*. It deals with the conventional field of general properties of matter in a fairly orthodox and rigid manner. The chapter on the flow of liquids and solids contains much new material, particularly, interesting details of recent work on the flow of solids and non-Newtonian liquids.

A mathematical introduction helps the First Year Honours student to grasp the basic mathematics required for studying the book. Several new experiments have been added, which should make laboratory work extremely interesting. Of special significance are the problems given at the end of each chapter. The young aspirant for the Honours Degree should aim at working out the entire collection. The historical background of each chapter is admirably presented, enabling the reader to appreciate the difficulties of the early workers in the field. It may be mentioned in passing that experienced teachers may not find it easy to reconcile themselves to the metamorphosis of 'acceleration due to gravity' (the familiar g) into 'intensity of gravity'.

It cannot be gainsaid that students and teachers of physics will find much in the book which will be useful and stimulating. We await with interest the other text-books of the series by the same author.

S. R. R.

Starch and Its Derivatives, Vol. I. 3rd Edition. Edited by J. A. Radley. (Publishers: Chapman & Hall Ltd.) Pp. 510. Price 65 *sh.* net.

Notable advances have been made in recent years, particularly in the United States, in the elucidation of the structure, chemistry and behaviour of starch, and Mr. Radley in editing this book has very wisely enlisted the co-operation of prominent workers in the specialised fields of starch chemistry and technology, both in the United States and in the United Kingdom to write special articles on different aspects of the subject.

In Part I of this volume, there are 17 chapters dealing with the structure and reactions of starch, while in Part II are found 7 more dealing with amylases and their action on starch. All the chapters have been written in a concise and authoritative manner, with extensive references to literature. The chapter on waxy cereals and starches deserves special mention since a comprehensive account of the botany, genetics and agronomy in addition to the chemistry of these materials has been presented.

One may perhaps criticise the manner in which in a third edition published in 1953, methods introduced as long ago as 1937 and 1941 have been dealt with (pages 91 and 119), as though they were very recently worked out. Further, the role of inositol as an active constituent of pancreatic amylase is very briefly dealt with in page 372, overlooking the later investigations of Fisher and Bernfield and others on this subject. However, these are only minor blemishes in what is otherwise a very commendable effort. Undoubtedly, this volume can be considered as a most comprehensive and up-to-date treatise on the subject of starch and its derivatives.

P. S. SARMA.

Specifications for Insecticides. (*Fourth Report of the WHO Expert Committee on Insecticides.*) (World Health Organization Technical Report Series, No. 54.) Pp. 98. Price 5/-.

New standards, replacing those recommended at previous sessions, were adopted for the following insecticides: technical DDT, technical benzene hexachloride (BHC) and its concentrates, technical methoxychlor, technical chlordane, water-dispersible powder concentrates of DDT and of BHC, and DDT emulsion concentrates. Technical dieldrin, pyrethrum extract, and certain emulsion concentrates were among other substances considered for which standards were formulated.

Specifications for aerosols, diluents, solvents and emulsifiers, as well as certain data on the preservation of insecticides under various climatic conditions, are also to be found in the report.

In addition to the description of test procedures, the annexes contain sampling instructions, and on account of a provisional method for testing aerosols which has been successfully employed in the United States of America.

Books Received

Text-Book of Genetics. By William Hovanitz. (Elsevier Publishing Co., Ltd.). Pp. xii + 420. Price 42 *sh.* 6 *d.*

The Geology of Ireland. By J. K. Charlesworth. (Oliver & Boyd, Ltd.), 1953. Pp. xvi + 276. Price 25 *sh.*

Methods and Principles of Systematic Zoology. By Ernst Mayr. (McGraw-Hill Book Co., New York), 1953. Pp. viii + 328. Price $ 6.00.

Chemical Constitution. By J. A. A. Ketelaar. (Elsevier Publishing Co.), 1953. Pp. viii + 400. Price 40 *sh.*

High Energy Nuclear Physics. Compiled and Edited by H. P. Noyes, H. Camac and W. D. Walker. (Interscience Publishers, Inc.). Pp. 110. Price $ 2.00.

Chromosome Breakage. Symposium held at the John Innes Horticultural Institute. (Cliver & Boyd, Ltd.), 1953. Pp. viii + 316. Price Rs. 45.

Text-Book of Optics. Second Edition. By N. K. Sethi and S. B. Raizada. (Premier Publishing Co., Delhi), 1953. Pp. 431. Price Rs. 10.

Geometrical Optics. By C. Curry. (Edward Arnold & Co.), 1953. Pp. viii + 174. Price 35 *sh.*

The Stability of Rotating Liquid Masses. By R. A. Lyttleton. (Cambridge University Press), 1953. Pp. 150. Price 35 *sh.*

Flames, Their Structure, Radiation and Temperature. By A. G. Gaydon. (Chapman & Hall), 1953. Pp. xii + 340. Price 55 *sh.*

Facts, Files and Action, Part II. By Holmstrom, Ph.D. (Chapman & Hall), 1953. Pp. xvi + 280. Price 32 *sh.*

Projective Geometry and Projective Metrics. By Herbert Busemann and P. J. Kelly. (Academic Press Inc.). Pp. viii + 332. Price $ 6.00.

Theory of Equations. By Prof. H. W. Turnbull. (Oliver & Boyd). Pp. xii + 166. Price 6 *sh.* net.

Integration of Ordinary Differential Equations. By E. L. Ince. (Oliver & Boyd). Pp. viii + 146. Price 7 *sh.* 6 *d.* net.

The Astonishing Atom. By John Rowland. (E. J. Arnold & Son Ltd., London). Pp. 120. Prce 4 *sh.* 6 *d.* net.

International Council of Scientific Unions, 1952. Vol. VI. (Cambridge University Press), 1953. Pp. viii + 158. Price 7 *sh.* 6 *d.*

Primates—Comparative Anatomy and Taxonomy. (I-Strepsirhini). By W. C. Osman Hill. (Edinburgh University Press). Pp. xxiv + 798. Price £ 5 5 *sh.*

Endosymbiose Der Tiere Mit Pflanzlichen Mikroorganismen. By Paul Buchner. (Verlag Birkhauser, Basel/Stuttgart). Pp. 772. Price S. Fr. 66.50.

Chemistry of Carbon Compounds, Vol. II. (Alicyclic Compounds). Edited by E. H. Rodd. (Elsevier Publishing Co.), 1953. Pp. xx + 486. Price £ 4 4 *sh.*

SCIENCE NOTES AND NEWS

Total Synthesis of Cortisone

A new method of making cortisone from simple, readily available chemicals devised by Dr. Lewis H. Sarett and a group of research chemists of Merck and Company, Inc., has been recently announced. An interesting feature of the synthesis is that the essential oxygen atom at position 11 of the cortisone molecule is built into the nucleus right from the beginning. An oxygen atom in one of the starting materials, benzoquinone, is retained throughout the synthesis, finally becoming the 11-oxygen of the cortisone structure. Dehydrocorticosterone and 11-ketoprogesterne were synthesized as a part of the procedure. It is also relevant to add that through the many improvements in the manufacturing process, cortisone is now readily available at a price less than a tenth of the original figure.

Radio-active Iodine for Goitre

Radio-active iodine, produced by exposing iodine to atomic radiation, has proved successful in treating toxic goitre.

Used both as a tracer and in treatment, its success is due in part to the avidity of the thyroid gland for iodine. After a dose is given, most of the iodine is soon concentrated in the thyroid gland, while the rest is thinly distributed throughout the rest of the body. A healthy thyroid gland absorbs about 500 times as much iodine as an equivalent amount of any other organ or tissue; an overactive thyroid from 1,000-1,500 times as much. Thus a tracer dose of radio-active iodine will show quickly and accurately the state of the thyroid's health and activity. If the tracer does confirm the diagnosis of hyperthyroidism, a much larger dose is administered and the radio-active atoms, on reaching the thyroid gland, destroy enough thyroid cells to reduce the harmful overactivity of the gland.

Ship Testing at Poona

The ship-testing tank recently installed at Poona with the aid of a UNESCO grant is part of a 120-acre outdoor laboratory covered with miniature models of harbours and rivers. Models can be driven through it, suspended from a 3-ton carriage 30′ long and riding on rails 14′ apart.

Experiments in ship-testing tanks are usually made with models of wood or paraffin wax upto 15′ in length. The carriage at Poona is capable of driving a model at a speed of 16′ miles per hour but, in actual practice, it will run much more slowly. Two miles an hour is usually sufficient to test a scale model of the hull of an 8,000-ton ship.

While the model is being towed through the tank, instruments register its resistance and, at the same time, photographs are taken of its bow wave and wake; later, the model can be tested with a wave-generating machine in the tank to show how the full-sized ship will behave in high seas. The tests at the Poona tank are being carried out under the direction of C. V. Gole, an Indian engineer.

Eighth Pacific Science Congress

The Eighth Pacific Science Congress will be held in Philippines on November 16-18, 1953. A number of symposia relating to oceanography, geology, geography, anthropology and biology pertaining to that region have been arranged. Among the International Organisations participating in the Congress are the UNESCO, WHO and FAO.

UNESCO Grant for Study of Desert Animals

Jaswant College, Jodhpur, has been awarded a grant of $ 2,835 by UNESCO for a study of the habits of wild and domestic animals in the desert of Rajputana and their role in the maintenance, and even the spread, of desert conditions there. The work will be started in July under the direction of Dr. Daya Krishna, Professor of Zoology at the College.

Allahabad University

Prof. S. Ghosh has succeeded to the Chair of Chemistry at the Allahabad University in the place of Prof. N. R. Dhar who has retired after a distinguished record of service in the University.

Dr. K. A. Chowdhury

Dr. K. A. Chowdhury, Wood Technologist, Forest Research Institute, Dehra Dun, has been invited by the Organising Committee of the Eighth International Botanical Congress to be held in Paris in July 1954 to be a Vice-President of the Palæobotany Section, and to preside over the symposium on "Fossil Woods—Convergent Wood Structure".

941-53 Printed at The Bangalore Press, Bangalore City, by C. Vasudeva Rao, Superintendent and Published by A. V. Telang, M.A., for the Current Science Association, Bangalore
Editor: Prof. G. N. Ramachandran, A. C. College of Technology, Madras 25.